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VIEWS, NEWS AND INTERVIEWS.

It is reported that successful experiments for destroying moths and other insects in forests have been recently made in Saxonia. A revolving search-light was erected and set to work. Large numbers of insects were attracted and were then killed by an incandescent platinum screen, which was fixed around the lamp.

The bicycle has hit the horse a blow between the eyes at Mankato, Minn. The street railway company of that city has resolved to suspend the running of its horse cars after having been in operation eight years. Let the company equip its lines with electricity and the bicycle may follow the horse.

A German paper, says the London *Electrical Engineer*, speaks of the advantage of numbering each incandescent lamp as it leaves the works; but the plan of ticketing them with an adhesive label takes too much time, and there is the risk of the ticket coming off. It therefore recommends writing directly on the glass, and gives the following formula: Dissolve 36 grammes of sodium fluoride and seven grammes of potassium sulphate in 500 grammes of water. In another vessel 14 grammes of zinc chloride are dissolved in 500 grammes of water and 65 grammes of hydrochloric acid are added to the solution. Immediately before writing the inscription, equal parts of the two solutions are mixed and applied to the glass either with a pen or a pencil. An indelible inscription is said to be the speedy result.

The new cable up the Amazon River will run 1,200 miles westerly from Para to Manaos. There are now about 12,000 miles of telegraph line in Brazil.

A dispute which has been going on for some time between the Electrical Workers' Union and the Theatrical Protective Union over the laying of electric wires on the stages of New York city theaters was settled recently by the arbitration committee of the board of walking delegates. By the terms of the settlement all the electric wiring behind the stage will be done by the Theatrical Protective Union and all before the stage by the Electric Wiremen's Union. This does not apply to the building of new theaters, in which case all the work of electric wiring is to be done by the Electric Wiremen's Union.

It is said that M. Lebon, French Minister of Commerce, announces that a contract has been signed for laying a submarine cable between Brest and New York and for a link between the French cable system and the Antilles.

The Arlington street church, in Boston, has had installed a set of electric chimes and an electric organ. A special recital for exhibiting the qualities of the organ will be given soon.

An Economical Poem.

[*From the Mankato Review.*]

Some cooks bake with cottolene,
" " " " lard,
" " use no grease at all,
But their crust's mighty hard.

Some men chew their plug tobacco,
" " " the tag,
" " never work their jaw
Except to chew the rag.

Some men put their ads. in papers,
" " " them on the fence,
" " never advertise,
Who ought to have more sense.

THE PROPOSED JUNGFRAU ELECTRIC RAILROAD.

BY V. M. BERTHOLD.

Probably no enterprise has aroused such universal and deep interest among the electrical fraternity, both of Europe and the United States, as the proposed Jungfrau railroad, which shortly will be a *fait accompli*, a lasting monument of the energetic spirit of the Swiss Republic.

The readers of the ELECTRICAL REVIEW doubtless remember the short description of the road, published as early as January 9, 1895, and, *en passant*, it may not be out of place to mention that the ELECTRICAL REVIEW contained the first information of the enterprise among the rest of its electrical contemporaries.

FIG. 1.—BIRD'S-EYE VIEW OF THE PROPOSED JUNGFRAU ELECTRIC RAILROAD.

We now offer two excellent illustrations of the route of the proposed Jungfrau road. A cursory glance at the subjoined views impresses at once the beholder with the magnitude of this marvelous enterprise, and the hardihood of the electrical engineer whose brain evolved what may well be styled the "eighth" wonder of the Old World.

Times change indeed! In the Middle Ages the haughty Spaniard used to say proverbially, "Quien no ha visto à Grenada, no ha visto nada" ("If you have not seen Grenada, you have seen nothing"). With equal pride the Americans were wont to remark that a sight of the Brooklyn Bridge was absolutely indispensable for any one desiring to be considered a civilized human being. But what is the gigantic iron girdle that unites the two metropolitan cities when compared to the Jungfrau enterprise? Indeed, at the *fin de siècle* the countrymen of the "fabulous" Tell will be entitled to proclaim as confidently, "Quien no ha visto Die Jungfraubahn, no ha visto nada."

It was stated in the January article that Scheidegg, a station of the Wengernalp, had been chosen as the starting point, and this station is clearly shown in the accompanying view. The road then climbs the Eiger Mountain until it reaches the Eigergletscher (glacier), 10,496 feet above the level of the sea.

It now enters a tunnel which will be constructed in galleries, *i. e.*, there is to be a horseshoe bend within the mountain. After emerging therefrom, the road runs in a straight line to the Mönch station, whence it winds downward to the "Jungfraujoch," and finally arrives at the plateau of the famous mountain by means of long spirals.

As the various financial points of the enterprise have already been mentioned in the January article, it seems unnecessary to rehearse them.

The following is, however, a short abstract from the latest available information concerning the Jungfraubahn, published by order of the magistrates of the townships of Gründlichswand and Lauterbrunnen.

It is proposed to use the water of the "White Lütschine," a rivulet which can easily furnish 5,000 liter, or 4,540 quarts, per second. Careful measurements show that there is plenty of water during the Summer season, and that no trouble is likely to occur. The engineers estimate that the amount of water is sufficient to produce 4,400 effective horsepower, which, in the form of electric current, will then be conducted through a cable to the point of consumption.

In order to use the water of the White Lütschine most advantageously

the engineers propose to build two power installations—one at Lauterbrunnen, the other at Sandweidli.

The Lütschine River has two distinct falls—one at the Lauterbrunnen station, below the junction of the Greifenbach and extending a short distance below the Studi brook. Here the first turbine wheels will be placed, the water descending from a height of 35.37 metres (about 118 feet). By means of a dam the water, prior to its descent upon the turbine wheels, is collected in a reservoir. It is intended to place in the power station four 470 horse-power turbines, one to be kept in reserve in case of accidents. Each will be coupled directly to a dynamo of equal horse-power, and in addition two 35 horse-power turbines shall be employed to drive two small dynamos which serve to excite the larger ones. As above stated, this installation is capable of developing 1,400 horse-power.

The second section of the work commences at the so-called Sandweidli, and continues as an open canal through the woods of Schmelzi to the Hinter Egg in the township of Gründlichswand, whence, by means of two large pipes, the water, from a height of 67.49 metres, is thrown upon the turbine wheels. The second power house will contain four turbines, each furnishing 1,000 horse-power, one to be held in reserve. As in the former case, the turbines are coupled directly to the dynamos, which can develop 3,000 horse-power. It is proposed to construct the road in sections, and the first, which commences at the little Scheidegg to the first tunnel, is to be opened during the next year. Immediately thereafter the tunneling will be started and the second section finished. As the summit in its present condition does not offer the necessary facilities for the accommodation of travelers, a certain portion of the rock will be blasted to furnish space for houses, etc. The report of the committee which has been appointed by the federal government in connection with this enterprise states that 20 years ago, when it was proposed to tunnel the Simplon, it was argued that the task was impossible, for at a certain distance from the entrance of the great tunnel the heat of the rock would be 30 degrees, a temperature unbearable for men and beasts. To-day the temperature within the Simplon tunnel is kept by artificial means below 20 degrees, though a large portion of the rock actually shows 40 degrees. The subjoined table shows the vast progress that has been made in the construction of great European tunnels:

	Mont Cenis.	Gotthard.	Simplon.
Length of tunnel in metres	12.849	14.998	19.731
Height of point of culmination in metres	1,293.7	1,154.8	705.2
Highest temperature of the rock	29.8	30.8	40
Expense of construction in francs	75	66	65
Cost of tunnel per kilometre*	6	4	3
Yearly progress of tunnel in kilometre	1	2	4

*Kilometre = 0.62 English mile.

In other words the Simplon tunnel will be finished at half the unit of cost of the Mont Cenis tunnel, so that the construction of the Jungfraubahn may safely be placed at not more than 8,000,000 francs, or $1,600,000. In regard to the number of people which at one time may be transported to the summit of the Jungfrau, the available space will accommodate about 50 persons.

The road when finished will be not only the highest *electrical* railroad, but the highest railroad of the world, a unique monument of the skill of the modern engineer and of the latent possibilities of electric power, and in a few years a trip to the snow-clad summit of the silent Jungfrau may be as common an affair as a visit to Mars and Venus, or a trip to Coney Island!

ELECTRIC LIGHT FLASHES.

Portland, N. D., wants an electric light plant.

The Chester, Pa., Electric Light Company has reduced the price of light.

The electric light companies are said to contemplate consolidation. This is an additional argument why the city should have its own electric light plant.—*Philadelphia Item.*

The electric light company at Keene, N. H., has purchased a second 50-light dynamo for street light work and the machine is now being connected and placed in position at the station.

If there ever was a time the city needed fewer policemen than have been necessary in the past, that time is now, since the brilliant illumination of the city by electric lights. Thieves hate light, and thugs despise it, and as a result (which the police annals will prove) there has been less thievery, less burglary and less thuggery in the city of Jacksonville since the city was lit by electricity than there has been in almost any corresponding period of the city's history.—*Jacksonville, Fla., Times-Union.*

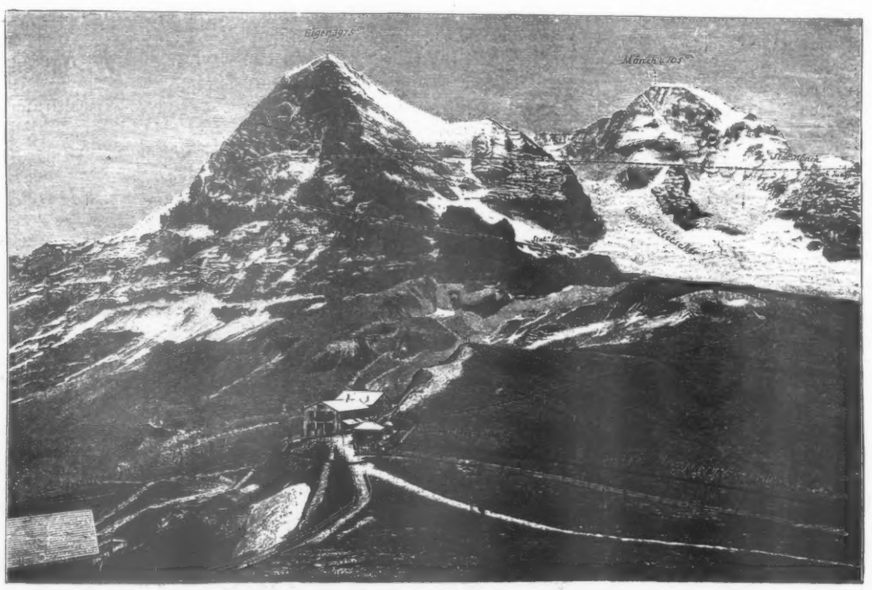

FIG. 2.—THE JUNGFRAU ELECTRIC RAILROAD FROM THE SUMMIT OF SCHEIDEGG TO MÖNCH MOUNTAIN.

The City Council of Springfield, Mo., has passed a five-year electric lighting franchise.

The Stafford Springs, Conn., Electric Light Company began its all-night service on October 1.

The electric light plant at Charlevoix, Mich., owned by a Saginaw syndicate, is now in operation.

The Capital Electric Company will light the State Fair grounds at Springfield, Ill., with 150 lights.

The Jersey City, N. J., Electric Light Company has increased its plant by adding a new Corliss engine of 800 horse-power.

The Edison Electric Illuminating Company of New York has declared a quarterly dividend of one and one-half per cent, payable November 1. Books close October 15.

The St. Johnsbury, Vt., Electric Company had their power circuit ready for service on October 1. After October 15 there will be a day as well as a night service.

TELEPHONE NEWS AND COMMENT.

It is rumored that the Standard Telephone Company will establish a telephone manufactory at Pittsburgh.

The New York & Pennsylvania Telephone Company has declared a regular quarterly dividend of one and one-half per cent, payable October 15.

The new telephone exchange at Sandusky, O., was opened last week with 375 subscribers — 200 Bell patrons and 75 new ones. The telephones were installed by the Harrison company. The circuits are all No. 14 hard drawn copper; of these all in the business portion of the city are 50 and 200 cable. The company's new directory will soon be issued.

William Findlay Brown recently introduced into the Philadelphia Select Council an ordinance authorizing the Mayor to have prepared plans and specifications for the construction of a public telephone system, and to advertise for proposals for the sale of the privilege to construct, maintain and operate the system. The ordinance was referred to the Electrical Committee.

The Tidewater Telephone Company, Gloucester Court House, Va., sends the following: A colored brother visited our exchange some years ago. He looked on with open-mouthed wonder as the operator made connections, took telegrams, etc. Of course, the operator said "hello" every time he answered a call. The colored brother made no comment on the mystery of talking to a man at a distance, but said very solemnly, "A Christian man kyarn't run that thing, can he?"

LITERARY.

We have received Baldwin's "Guide to Systematic Readings in the Encyclopedia Britannica," published by the Werner Company, Chicago and New York. The design of the book is to direct the reader where to find all information contained in this great work on any desired subject, and thus to render its vast field of information available not merely for reference, but for educational reading. The book is divided into three parts—for young people, the student and the business man. The first department embraces courses of reading in history, biography, familiar science and games and sports; the second department embraces courses in history, literature and the various natural sciences; the third part embraces courses relating to the different trades and professions. The book will prove of valuable service to those who have the Britannica, in enabling them to exhaust any given subject and to find without trouble all the captions under which it is discussed.

Brooklyn Electrical Society.

The opening lecture of the season of 1895–6 was delivered on Tuesday evening, October 1, by C. J. Field, on "Electric Railroads and Their Construction."

THE PORTLAND, ORE., POWER TRANSMISSION PLANT.

AN INSTALLATION EMBODYING INTERESTING ELECTRICAL PROBLEMS.

The work of utilizing the great water powers of the Far West is going on rapidly. Within the past month two electrical plants for the transmission of power from water falls over long distances have been installed. That at Sacramento, Cal., has proved the feasibility of economically transmitting the power of a fall to a distance of nearly 25 miles. That at Portland, Ore., is still more important and presented many new electrical problems. These have been successfully solved and the thriving city of Portland is now benefiting by a service of electricity from a water fall more than 12 miles away.

This installation was made by the Portland General Electric Company, of which Mr. F. P. Morey is president. The company owns the entire water power of the falls on the Willamette River at Oregon City, 12 miles above Portland, which, with a head of 40 feet, has a minimum capacity estimated at 50,000 horse-power. Part of the power has already been utilized by numerous factories and mills erected near by, and in addition to these an electric station erected some years ago has supplied current for lighting the streets and dwellings of Portland and for operating an electric street railway between Oregon and Milwaukee, seven miles away, the direct current and high frequency alternating systems being used.

In order to take advantage of the power of the falls, the Portland General ElectricCompany has constructed the first part of an extensive station on the west side of the Willamette River opposite the city of Oregon. The part constructed is one-quarter only of the building, which is being put up in sections. Twenty sections will complete the building; five are already built and foundations are now being laid for the remainder. The ultimate generating capacity of the station will be 12,800 horse-power.

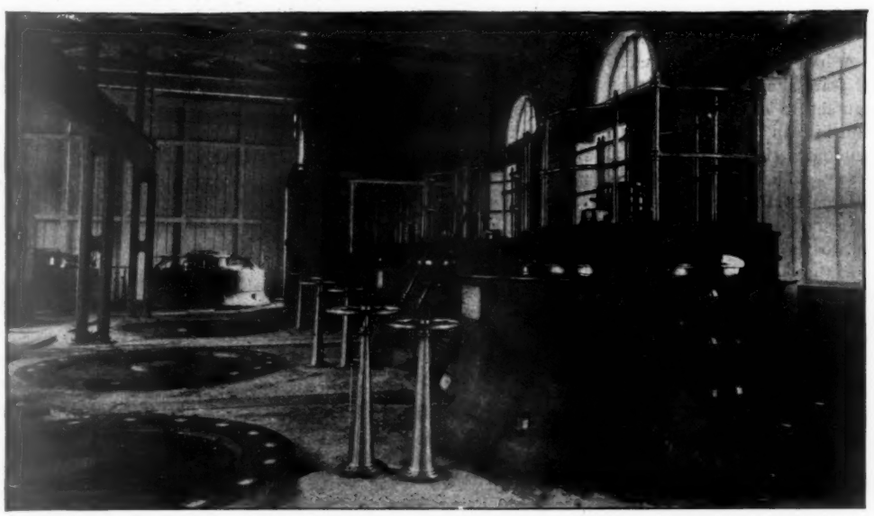

FIG. 1.—INTERIOR OF PORTLAND, ORE., TRANSMISSION STATION, SHOWING THREE-PHASE GENERATORS AND TWO DIRECT-CURRENT EXCITERS.

In addition to the land covered by the station, the Portland General Electric Company has purchased about 1,600 acres in the vicinity. It also controls the canal and locks on the west side of the river, constructed to allow of the passage of vessels past the falls into the navigable waters above, extending 75 miles inland. To construct this canal, the State of Oregon contributed about $200,000 the balance being supplied by the Portland company.

The station building is of concrete, stone, iron and brick, and when finished will have a length parallel with the river of 364 feet. The water is taken from the canal, led through an extensive hydraulic installation and discharged into the river below on the other side. The water-wheel plant is from the works of the Stillwell-Bierce & Smith-Vaile company, of Dayton, Ohio, and consists at the present time of three units, each consisting of a pair of vertical cylinder gate improved Victor turbine wheels, 42 inches and 60 inches in diameter respectively. The larger wheel is an auxiliary, to be brought into service only at periods of excessive high water, which the records show occur about once in every five years. The smaller wheel runs at a speed of 200 revolutions per minute and the larger at 100 revolutions per minute. Both turbines are set at the same level, and each carries a pulley, that of the 42-inch wheel being fixed to the generator shaft. When the large wheel is in operation the two pulleys are belted together, the smaller wheel is disconnected, and the large wheel drives the generator at a uniform speed of 200 revolutions. When the smaller turbine is operated alone the belt lies upon a shelf surrounding the pulleys.

The weight of the vertical shaft, with the armature, is about 33,500 pounds, and to carry this a system of extra bearings is introduced, one of the ring-thrust type and the other an hydraulic oil bearing, both supplementing the ring bearings on the armature shaft. They are enclosed in cases filled with oil delivered by hydraulic pressure, and are surrounded by water jackets.

The length of the generator shaft is 29 feet, and eight and three-eighths inches in diameter. It is not a continuation of the shaft of the wheel, but is coupled to it by means of a disk coupling, which allows of a certain free movement up and down of the generator shaft. The shaft of the 60-inch wheel runs from the coupling to a bearing set in the floor of the station. Both wheels in each section are controlled by hand wheels and both are regulated by the same governor. The belt tightener is also controlled from either floor by a hand wheel.

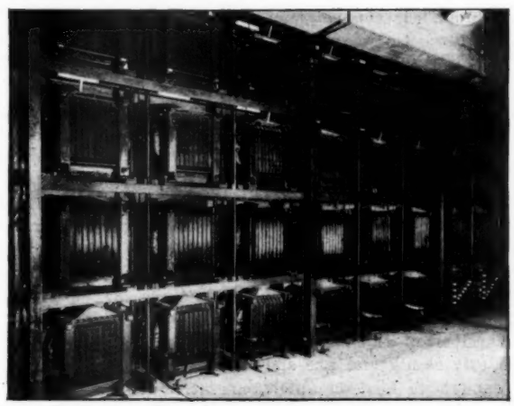

FIG. 2.—THE REDUCING TRANSFORMERS IN THE PORTLAND, ORE., TRANSMISSION STATION.

The water is admitted to the penstocks from the upper canal by means of a head gate operated from a platform on the canal side of the station. Each penstock is 10 feet in diameter and is constructed of riveted steel plates. Each wheel has its own flume, the water passing first through the large flume of the larger wheel to the flume of the smaller wheel, whence it passes through a tube into the tail race. In addition to this turbine equipment, an auxiliary power equipment has been furnished, consisting of a set of pumps, including a hydraulic pump for supplying oil to the thrust bearing cylinders and a duplex water pump to circulate the water in the cylinder water jackets. They are operated by two 15-inch horizontal turbines enclosed in the same flume.

For the operation of the exciters a further pair of vertical turbine wheels has been installed, each 48 inches in diameter, driving the generators by a similar system to that already described for the operation of the main machines.

The complete power plant will consist of 20 three-phase generators and two direct-current generators, acting as exciters. The total capacity of the station, therefore, will be 12,800 horse-power, divided into 20 units, each one independent of the other.

In order to obtain the desired results from the power at its disposal, the Portland General Electric Company selected the three-phase system of electrical power transmission as developed by the General Electric Company, which has proved so satisfactory in the majority of power transmission installations of varying sizes and varying distances in this country.

One peculiar feature of the Portland installation is the employment of large blocks of power for street railway service, involving the transformation of the polyphase current sent over the line into direct current for railway circuits. The frequency is 33 cycles per second, selected on account of the large amount of power which it was necessary to convert from alternating into direct current. The current is delivered directly to the line without first passing through transformers and when it reaches Portland is transformed down to a potential of 400 volts. For the power service the step-down transformers are connected to rotary converters, which will deliver a continuous current of 500 volts for street railway service, as well as for the operation of stationary motors. Induction motors will also be used directly connected to the secondaries of the step-down transformers, when this can be done to advantage.

The five sections of the building already erected are occupied in the following order: The first section contains the pumps and the accumulators for the complete station; in each of the three following sections is one three-phase alternating current generator of 450 kilowatts or 600 horse-power capacity, and the fifth section contains two 250-kilowatt multiphase continuous current generators used as exciters. Each exciter is capable of exciting all of the 20 three-phase generators, and the second has been set up as a reserve in case of accident to the first. At present, one is furnishing direct current to the street railroads in Oregon City. When the station is complete, the exciter section will be removed from the fifth section, which it occupies at present, and will be placed in the center section of the building, where the switchboards will also be erected.

(To be concluded.)

The Baltimore Electric Locomotive.

[From the Railroad Gazette.]

It is well worth a trip to Baltimore to see the locomotive pull a train, and the experience of the next six months with this plant may be very interesting to electricians as well as to railroad men who are looking to electric locomotives to bring back the passenger traffic which the street lines have "stolen." It may be well to say in closing, that this theft is simply an illustration of the fact that the natural public, like nature herself, follows the line of least resistance, and it is often easier and more comfortable to take the trolley car than to walk to the station and wait for a train.

The Smart Burglar and the Telephone.

"About five years ago," said the Chicago man, "I had a telephone put into my residence for the convenience of it, and for a time it was, as you say, not such a bad thing to have around. I put it in in October and it went well enough until the following August, when my wife and family were away for the Summer, leaving me in charge of the house. One night I came in about 12 o'clock, as Summer widowers are known to do occasionally, and I sat down in the library to smoke one more cigar before going to bed. It wasn't long until I dozed off and presently I was aroused by a noise in the hall.

"I was awake on the instant and in another minute I was sure I had a visitor who wasn't expecting me any more than I was expecting him. I had a loaded revolver in my desk drawer, and very quietly I took it out and waited developments. They came quickly and in about five minutes the gentlemanly and urbane burglar had entered the library. I had been sitting there in the dark, or only such light as came from the street, and when Mr. Burglar came into the room I touched the button and the electric light showed him up nicely, and I was just before him with my gun trained on him. I had him and he knew it, and he made no resistance whatever. I don't think I was ever cooler and clearer-headed in my life, and I felt like a conquering hero when he held up his hands and begged me not to shoot.

"'I won't,' said I, 'unless you disobey me. Go over to that telephone,' I went on, as steady as a clock, 'and ring up the police station. I don't know the number, but you will find it in the book hanging there, and if you make a false move I'll shoot you full of holes. Ring her up!'

"He was scared, I could see, for his hand shook when he took the book, but he found the place and called up the number.

"'Now, tell them to come to this street number,' and I gave him my name and number, 'and say to them that I have a burglar ready to be taken to the station.'

"He followed instructions beautifully, and then I sat down to wait, while I kept him with his face to the wall and my revolver ready to prevent accidents. In 20 minutes or half an hour there was a ring at the front door bell and I marched him down to meet the officers. With one hand I unlocked the door and with the other kept the gun trained on my robber, and as I pulled it open two men came in with a rush, and the next thing I knew I was bound hand and foot and gagged, and my burglar, with two of his pals, had possession of the place.

"Then they finished the job at their leisure, taking everything they wanted, and at last went away, after giving me several parting kicks and otherwise showing their disregard of my rights in the premises. All the time I was wondering why the police hadn't come, and perhaps would be still wondering if the gents hadn't told me when they were departing that their captured partner had called up their number instead of the station number, and that they had caught on and come around in a hurry. It was the merest luck in the world that the snap had worked, but it was enough to disgust me with a telephone, and now I haven't one in my house, and sometimes I am almost tempted to sue the confounded company for damages, for those thieves got away with $1,000 worth of stuff that never did turn up again."—*Washington Star.*

Asbestos.

Asbestos is a wonderful substance, says the *Engineer*. The name comes from a Greek word meaning inconsumable. Fire will not burn it; acids will not gnaw it; weather will not corrode it. It is the paradox of minerals, for it is quarried just like marble. The fibers of which it is composed are soft as silk and fine and feathery enough to float on water. Yet in the mines they are so compressed that they are hard and crystalline like stone. Although the substance has been known for ages in the form of mountain cork or mountain leather, comparatively little has been learned as to its geological history and formation. A legend tells how the Emperor Charlemagne, being possessed of a tablecloth woven of asbestos, was accustomed to astonish his guests by gathering it up after the meal, casting it into the fire, and withdrawing it later, cleansed, but unconsumed. Yet, although the marvelous attributes of asbestos have been known for so long, they were turned to little practical use until about 20 years ago. Since that time the manufacture of the material has grown until it can take its place with any of the industries of this country. Indeed, so rapid has been its progress and development, that there is almost no literature of any kind on the subject, and, to the popular mind, it is still one of those inexplicable things.

Up to the late seventies, nearly all the asbestos used to come from the Italian Alps and from Syria, but one day explorers discovered a rich deposit in the eastern township of Quebec. Companies were formed, and in 1879 the mines were opened. Remarkable as it may seem, however, although the Canadians started factories, in the operation of which they were substantially backed by English capital, it was an American concern, with headquarters in New York, that developed the industry most rapidly. The company has now grown so large that it has branches is nearly all of the large cities of the country, and the machinery used is specially made and peculiarly adapted to the manufacture of asbestos articles. There is also a large number of factories in England. The veins of chrysotile, as the Canadian asbestos is called, are from two to four inches in thickness, and are separated by thin layers of hornblende crystals. The nearer to the surface the veins run, the coarser are the fibers and the less valuable. The mining is done by the most improved machinery. Holes are drilled in long rows into the sides of the cliffs by means of steam drills. They are then loaded with dynamite and exploded simultaneously in such a way that a whole ledge of the rock falls at once. Then the workmen break out as much of the pure asbestos as possible, load it into tubs or trucks, which are hoisted out and run along to the "cobhouse." Here scores of boys are kept busily employed crumbling or "cobbling" the pieces of rock away from the asbestos and throwing the good fiber to one side, where it is placed in sacks for shipment to the factory. The greatest work in connection with the mining of asbestos is in disposing of the waste rock and the refuse of the quarry. Only about one-twenty-fifth of the material quarried is real asbestos, and the rocky parts have to be carried to the dumps at great expense. As the asbestos comes from the mine it is of a greenish hue, and the edges are furred with loose fibers. The more nearly white asbestos is the better its grade. The length of fiber is also of great importance, the longest being the most valuable. From the mines the asbestos is taken to the manufactories in the United States.

An Electrical Fishing Experiment.

The adventure of Meekin, the lazy inventor, in trying to electrocute a bass, as chronicled in the ELECTRICAL REVIEW, seems to have inspired M. Quad, of the *Detroit Free Press*, to similar efforts, as is shown in the following story of "The Dog Shark's Revenge:"

"No, I haven't been fishing this Summer," replied the man with the glass eye, when the query was put to him at the hotel. "I quit fishing five years ago, and I shall probably never land another bass."

"Down on your luck as a fisherist?" was asked.

"No, not exactly. As a matter of fact I used to have extraordinary luck in fishing. It was an accident that disgusted me with the sport, and the same accident caused me the loss of this left eye and laid me up for several months."

On being urged to spin his yarn he sighed heavily, took out and wiped and replaced his glass eye, and then said:

"I was living down on the east shore of Maryland, where the fishing is just immense, and was having more than my share of luck, when a fellow came down from New Jersey, and we got to be chummy. Afer a bit he let on that he was an electrician, and had invented a fish-killing torpedo. The torpedo was to be lowered into the water and exploded from an electric battery in the boat, and the explosion was warranted to turn up a boat load of dead fish. I didn't like the idea at all, but the thing was intended for market fishermen, and the inventor prevailed upon me to go out with him one afternoon and see how the old thing worked."

"Well?" was queried as the glass eye man made a long pause.

"Ah! Beg pardon! Yes. I went out with him, and by and by we dropped the thing overboard to let it trail away behind us about 100 feet and then explode it. We had some little trouble with the battery, and unbeknown to us the tide floated the torpedo back under the boat. When the explosion came the skiff was reduced to matchwood and we went sailing into the air. The torpedo man came down to go to the bottom and stay there, and I was rescued just at the last gasp."

"Did the explosion kill any fish?"

"Not a one."

"Your eye was lost in the explosion, of course?"

"No, sir. I wasn't hurt at all by the explosion, nor in going up or coming down. It was while swimming in the water that a dog shark came up on my left side, glared at me for a moment, and then deliberately turned round and stuck his tail into my eye and gouged it out."

"You don't mean it?" gasped one of the group.

"I mean every word of it, sir! The idea, of course, was to get even with me for the torpedo business, and this was fully accomplished. Yes, he made me a one-eyed man for life, and is it any wonder that I no longer care for the sport which formerly interested me so much?"

We looked at him for a long, long time in silence, and he closed his good eye and glared with the other at the diamond shirt stud on the bosom of the advance theatrical agent. By and by he rose up and said:

"I had forgotten to say that after gouging out my eye the dog shark swept his tail over my head and removed all the hair from my poll, thus rendering me bald-headed as well. I received from my mother in Boston to-day a new pocket Bible to replace the one I lost a few weeks ago, and if you gentlemen will excuse me I will go to my room and read a few chapters before turning in for the night!"

The Storage Battery.

[*From the Boston News Bureau.*]

Accounts of large profits made in the recent rise in storage battery stock reach Boston from Philadelphia. It is said that Isaac L. Rice, who had very little left after his campaign in Reading, has cleared $500,000 by the advance in storage battery shares, and it is also declared that the electric light consolidation, which is being formed in that city, is based upon the prospective saving of a few hundred thousand dollars through the use of the storage battery. It is the storage battery people who are making the consolidation.

OBITUARY.

Prof. Eli Whitney Blake, from 1870 until the close of the last college year Hazard professor of physics at Brown University, Providence, R. I., died at Hampton, Conn., on October 1. He was born in New Haven on April 20, 1836.

AN IMPROVED PORTABLE PHOTOMETER.

READ BEFORE THE BRITISH ASSOCIATION BY W. H. PREECE, C. B., F. R. S., AND A. P. TROTTER, B. A., A. M. I. C. E.

When light falls upon a surface, that surface is said to be illuminated. The illumination depends simply upon the light falling upon the surface, and has nothing to do with the reflecting power of the surface, just as rainfall is independent of the nature of the soil. As a rain gauge receives the full amount of rain when it is placed horizontally, disregarding wind, and receives less when it is tilted, so a surface is fully illuminated when it faces the source of light, and is less fully illuminated when the light falls upon it at an angle. The proportion between the full rainfall or illumination and the measured rainfall or illumination varies as the cosine of the angle of incidence of the rain or of the light. The angle is 0 degree, and the cosine is 1, when the rain gauge is placed horizontally or when the light falls perpendicularly upon the surface.

It would perhaps be unnecessary to call attention to these very elementary matters were it not that difference between the photometry of illumination and the ordinary photometry of candle-power is often confused.

The lighting of streets and of buildings may be specified by the maximum and minimum illumination. The primary purpose of an illumination photometer is to measure the resulting illumination produced by any arrangement of lamps, irrespective of their number, their height, or of their candle-power. Illumination photometers containing sub-standards of light have been designed by Professor Weber,† Professor Mascart,‡ and others. One of us described an illumination photometer before the Royal Society in 1883.§ This consisted of a box blackened within. Over the end was stretched a Bunsen screen of paper, on the middle of which was a grease spot. At a distance of 12 inches was another screen of drawing paper. The grease spot was so screened that no light fell upon it except that which was reflected from the drawing-paper screen. At the end of the box opposite the Bunsen screen was an eyepiece consisting of a plain tube. Within the box a small glow lamp was fixed, and in order to make a measurement of the illumination of the drawing-paper screen, the current through the lamp was varied by a rheostat until the grease spot was invisible. The readings were recorded in luces, a lux being suggested by one of us at the Paris Electrical Congress, 1889,‖ as the name for the illumination due to a carcel lamp at one meter, and equivalent to a British standard candle at 1.058 feet. The only defect of this photometer was the yellowish and reddish color of the lamp when dimmed for low readings.

In 1884 we designed a portable photometer,* in which the lamp could be moved towards, or withdrawn from, the Bunsen screen, and a mechanism was provided by which, when a pointer moved a certain distance over a uniformly divided scale, the displacement of the lamp was as the square of that distance. The Bunsen spot was viewed by Rudorff mirrors, in the usual way. This instrument worked well, but the range was small and could not be easily increased. The lamp would have to be moved to a very considerable distance from the screen for measuring the feeble illuminations met with in street lighting.

Eight years later, one of us experimented with modifications of this instrument and found that in ordinary street lighting the illumination is often only equal to that due to one candle at 14 feet distance. A large number of different methods of reducing the light were tried. Many combinations of lenses, the eclipsing device used in dissolving views, photographically shaded glass screens and other devices were used, and finally a white reflecting screen was inclined at different angles to a small electric lamp, and on this principle a photometer was constructed in February, 1892. It was found that the Bunsen screen could be replaced with advantage by a simple white cardboard diaphragm pierced with one or more holes.† The illumination of this diaphragm, generally in a horizontal position, was the illumination to be measured. Below this was the reflecting screen, enclosed in a box about two feet by six inches by five inches with a pair of small glow lamps and a secondary battery. The screen could be inclined towards the glow lamps by means of a chain wound up on a cam mounted on a spindle, the cam being formed so as to give an open scale. A hand or pointer on the spindle indicated readings on a dial. Many measurements and a number of photometrical surveys of different streets and public buildings in London were made in 1892, and were recorded by means of plans with isophotal contour lines and otherwise.* During the present year an improved form of this photometer has been constructed. The chain and cam, which allowed the instrument to be used only in a horizontal position, have been replaced by a system of levers. The object of these levers is to give an open scale. If the motion of the pointer were proportional to the angular movement of the screen, the scale would be approximately a scale of cosines. The instrument is shown in Fig. 1 with the lid open and the front let down. It measures one foot three and three-quarter inches by five and one-half inches by nine and one-half inches high (400 millimeters by 140 millimeters by 242 millimeters). On the end to the left there is a red glass window, and immediately within are two 12-volt lamps (one of which is shown in Fig. 2), one of about one candle-power and the other of two candle-power. It can be seen through the window if either or both of the lamps are alight. The lamps are held in special lampholders, capable of adjustment as to height by clamping screws. These clamping screws and the base of one of the lampholders are shown in Fig. 1. A switch on the top of the instrument enables either or both lamps to be turned on and off. At the other end of the box the reflecting screen is hung. The middle of the screen is about 11 inches (28 centimeters) from the lamps. It is shown in Fig. 1 in the lowest position. In Fig. 2 the screen and one of the levers, together with one of the rollers on which the screen rests, and the handle by which it is moved, are shown with the screen in its highest position by full lines, and in its lowest position by dotted lines. In its highest position the filaments of the lamps are a little below the plane of the screen; no direct light from the lamps then reaches the screen, and it is only faintly illuminated to about one-two-hundredths of one candle at a foot, by stray light, which is excluded as much as possible. The diaphragm is placed horizontally immediately above the hinged screen. Three small star-shaped holes are cut in it, and through them the illuminated reflecting screen can be seen. A handle carrying a pointer moving over a graduated scale controls the inclination of the screen by means of the levers and links. A guide, attached to the back of the screen (shown in Fig. 2), allows the instrument to be turned on its side without interfering with the working. In order to take a measurement, one or both of the lamps are turned on, and the handle is moved until the screen seen through the holes in the diaphragm matches the diaphragm in brightness. If the color of the light outside is about the same as that of the lamps, the middle hole may be made to disappear. The observer should stand approximately in the vertical plane passing through the three holes, so that he may see that part of the screen through them which lies immediately beneath them.

Various substances have been tried for the diaphragm and screen. Thin metal painted with a whitewash made of magnesia and isinglass is perhaps the best; the diffused reflection practically follows Lambert's cosine law, but the material is easily soiled and cannot be cleaned. Bristol board, from which the glaze has been removed by a damp cloth, closely follows the cosine law within the angular range required in this case. It is important that there should be no glaze on the surface of the hinged screen, since the inclination of the lamp to the screen and of the screen to the eye for maximum illumination is about 45 degrees. But as the scale is graduated by experiment, a slight departure from the cosine law does not matter. On the other hand, it is of greater importance that the screen should be very smooth and flat. Under very feeble illuminations, the light from the small lamp making an angle of incidence very nearly 90 degrees, minute irregularities are easily seen and make accurate readings difficult. For ordinary street lighting and for general industrial photometry a slight departure from the cosine law on the part of the diaphragm is of no practical consequence, so long as there is no perceptible glaze, for it is always observed nearly vertically and never at a large angle of incidence.

The color difficulty is reduced, in the first instance, by the freedom of motion of the levers. The handle may be quickly moved to and fro on each side of the true reading and the middle position may be estimated. In measuring the illumination due to arc lamps the color difficulty becomes troublesome. The color of the glow lamp in the photometer should be approximately a mean between the color of the standard of light wherewith the instrument is calibrated and that of an arc lamp. This halves the difficulty, which can never be entirely removed, since differently colored lights are not physically comparable; it may, however, be relegated entirely to the laboratory by the use of a colored screen and diaphragm.

If the hinged screen be tinted pale blue, some of the yellow rays of the lamp in the photometer are absorbed and the reflected rays approximate to grey; that is, to feebly illuminated white. On the other hand, if the diaphragm is tinted yellow, the white light from electric arcs, or of daylight, may be reduced to approximately the same color as that of the lamp in the photometer. In the first case the brilliance of the hinged screen is reduced and a brighter lamp would have to be used to restore the true value of the scale readings, and in the second case the brilliance of the diaphragm would be reduced and the scale readings would be too high. But by tinting both screens the calibration of the instrument need not be disturbed.

(Concluded on page 205.)

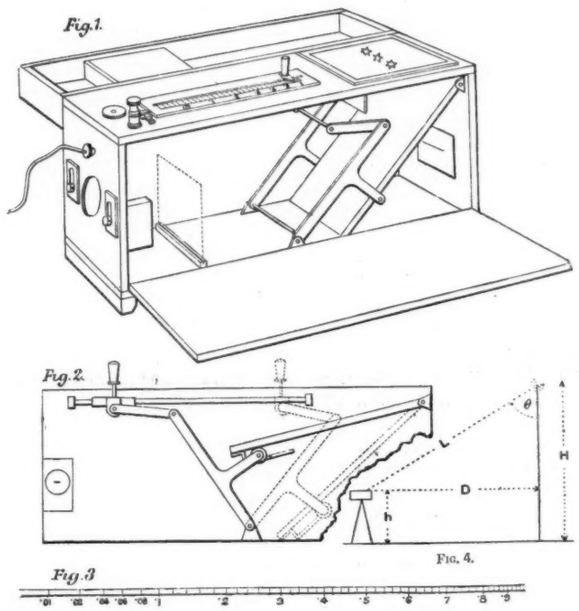

FIG. 4.

DIAGRAMS ILLUSTRATING PAPER ON "AN IMPROVED PORTABLE PHOTOMETER."

† *Electrotechnische Zeitschrift*, 1884, page 166. *Lum. Electrique*, vol. xii, page 468.

‡ *Bull. de la Soc. Int. des Electriciens*, 1888, page 109.

§ Proceedings of the Royal Society, vol. xxxv, page 39, 1883, and Proceedings of the Institution of Civil Engineers, vol. cx, page 98.

‖ The *Electrician*, vol. xxiii, page 478.

* Proceedings of the Institution of Civil Engineers, vol. cx, page 101.

† *Proc.* Phys. Soc., xii, p. 355 (1892). *The Electrician*, Vol. xxxi, p. 178.

* *Proc.* Inst. C. E., Vol. cx, pp. 42-51.

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SPECIAL NOTICE TO ADVERTISERS.

CHANGES for advertisements must be in this office by Friday noon for the following week's issue.
NEW ADVERTISEMENTS should be in the office not later than Saturday noon to insure publication the following week.

NEW YORK, OCT. 9, 1895.

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OPPORTUNITIES OF THE PRESENT.

It is admitted by prominent men and newspapers that make it their business to know the details of finance and who can judge important results by slight signs in the business world, that the revival of trade has come and is now getting a firm foothold in order to nullify the depression which has existed for the last two years. Recently we have exported to Europe American steel rails and American wool. General business is expanding, capital has conquered its unusual timidity, new companies in every line are being incorporated and insolvent enterprises are being revivified. Taken in the aggregate the signs of the times point to renewed prosperity and bid the manufacturer reach out boldly for business. It is no time for timid men—boldness in business will now count for more than it has at any time during the last 20 years. Opportunity is everything—the wise man will seize the one which is now so clearly pointed out.

In this connection we desire to remark that never before in its history has the ELECTRICAL REVIEW been so well equipped to be of service to its readers and advertisers. Our facilities for securing reliable and interesting news of the electrical and allied industries are first class, we have an alert and efficient staff of correspondents at our command, and our connections with the solid and influential men in the business are of the right kind. We occupy that perfectly independent position from which we can criticise and be criticised with equanimity and fearlessness. Best of all, the ELECTRICAL REVIEW is gaining paying subscribers at a very rapid and encouraging rate.

We believe in the signs of the times mentioned above and have planned a business campaign which we feel sure will benefit all our patrons as well as ourselves.

The new gas engine developed by Mr. George Westinghouse, Jr., promises to work a revolution in the economical generation of electric current. The crude results thus far obtained indicate that a saving of 50 per cent over steam power will be attained. We congratulate Mr. Westinghouse on his achievement and wish that all his hopes for the new engine may be realized.

WALL STREET AND THE ELECTRICAL STOCK MARKET.

The all important development in the financial world this week was a reduction of 1 cent in sterling exchange rates to a figure which renders it practically certain that there will be no further gold exports this Fall. The Crossman shipment of last week, aggregating $2,500,000, promised to be followed by another transaction for the same account. This, it developed, was in connection with the financing of the Russian-Chinese loan. Had not exchange dropped about this time heavy shipments would undoubtedly have resulted, as a premium was offered for the gold. The weakness, as noted, was due to rather free offerings of cotton and produce bills and a liberal supply of bankers' bills drawn against several large blocks of bonds sold abroad, as well as the sale of the Anaconda mine to the Rothschilds. The market for securities was surprisingly dull and indifferent to these favorable gold developments. The hesitancy which has been expressed off and on since the slump early in September was most pronounced and prevented any broadening of interest. This left the market in the hands of professionals and rendered it subject to any unfavorable development that might arise. On Friday the sudden check to the Kaffir mining speculation in Paris as a result of uneasiness in the Armenian troubles was reflected in the price of American shares and was followed by an all around decline in Wall street. This condition, however, is but temporary. Business continues to make rapid strides forward, as is shown in steady increases in bank clearances and railroad earnings. There is an excellent demand for money for crop moving purposes. This is reducing the surplus reserve in the New York banks and has already resulted in high interest rates both for call and time loans.

The feature of the week in the electrical field was the almost phenomenal advance in Electric Storage Battery. The price went up to 63 on Friday, a gain of over 7 per cent. Speculation during the week in this stock has reached a craze. The common shares less than two years ago were selling in Philadelphia at 50 cents. People who have sold out on the advance, thinking the price has gone high enough, have been buying back their lines. Those who waited for the reaction are still waiting. Conservative brokerage firms, who a week ago would have bought stock on a $10 margin, this week refused orders under less than $20, and were not willing to buy heavily even at that figure. As near as can be learned the advance of the stock is on its merits, although talk of 500, such as was indulged in during the week, is regarded as wild.

One of the causes of the advance is contracts which have been made for the coming year that will enable the companies to pay a dividend on the preferred stock. The same financiers who made a success of the United Gas Improvement Company and the

Welsbach light have taken hold of Electric Storage. It is stated with some show of authority that a company with $1,000,000 capital is being formed in this city to finance electric storage. There are hints of a large combination among traction companies of Philadelphia and New York, which may result in big storage battery contracts. A number of strong men were added to the directorate this week and three vacancies will be filled by three prominent New York financiers.

In General Electric there were the favorable rumors usually current when the stock is on the advance. The price ranged between 39 and 40 in the latter days of the week and appeared to have good support. Rumors of a strike at the Lynn works had no effect on quotations. It is somewhat positively asserted in Boston that good legal opinion has been obtained to the effect that General Electric preferred stock cannot be scaled in any correction of the capital impairment. If this be the case, the current price of about 70, which carries with it 14 per cent accumulated dividends, certainly looks cheap. There is even more talk current than has been usual of late regarding this adjustment of the company's finances. One plan suggested is to cut the common stock in two, issuing one share of new for two of old. It is said that the company is earning $15,000,000 gross and $3,000,000 net, per annum. Out of this sum allowance will have to be made for sums to be written off on account of depreciation, so that it can be said that the stock is not earning more than $3 per share. The debenture 5 per cent bonds of the company were in unusually good demand this week, advancing some 3 points to 93. This led to the report that the company was employing some of its surplus to buy in further amounts of the issue.

Everywhere in financial circles and to quite a general extent in the electrical field it is virtually agreed that a working arrangement between General Electric and Westinghouse in the matter of prices and output is necessary. The argument is that no business should be conducted at a loss or without fair profits. The General Electric people are rather inclined to the view that they are masters of the situation and refuse to make concession. The Westinghouse company is naturally anxious to obtain work for its new plant and to that end stipulates as a part of any agreement provision for an increase in its business. The field is pretty well farmed out at this time. The appearance of important contracts for the electrical equipment of steam roads, such as are promised in the not very distant future, may change the feelings of these two corporations towards each other.

The New York & New Jersey Telephone Company has declared a regular quarterly dividend of 1½ per cent, payable October 15, to stockholders of record at the close of business October 5.

On the Boston Stock Exchange Bell Telephone recovered its 3 per cent dividend. It sold on Monday at 197 and on Friday back to 200. New England was unchanged at 89½ to 90, Erie telephone lost a point to 63 and Electric Storage Battery was very active, advancing from 55⅞ to 63. The market for this stock is divided between Boston and Philadelphia. Westinghouse securities were unchanged at from 35½ bid to 36 asked for the common and 55 and 55½ for the preferred. BAIN.

New York, October 5, 1895.

The Latest News.

A press dispatch from Baltimore, dated October 6, says that electric locomotive No. 1, used in hauling freight trains through the Belt Line tunnel of the Baltimore & Ohio Railroad, demonstrated on Sunday that its drawing power far exceeds the expectations of its builders. Forty-four loaded freight cars and the three steam locomotives, not working, which had been used to haul the heavy train on the surface, were coupled to the electric giant at the tunnel entrance and pulled up the heavy grade of the tunnel, a speed of 12 miles an hour being developed. The total weight of the train was 1,900 tons. The drawbar pull exerted in starting this unusually heavy load was more than 60,000 pounds and continued throughout the trip at more than 40,000 pounds. Baltimore & Ohio officials claim that no steam locomotive has ever approached this record.

The Metropolitan Electrical Development Company has filed articles of incorporation in the County Clerk's office in Jersey City, N. J. The capital is $1,000,000, and the incorporators are John R. Dos Passos, Conrad N. Jordan, Thomas D. Jordan, Charles N. Canda and William L. Moore, of New York, and Charles N. King, of Jersey City. The company proposes to develop storage batteries for traction purposes and expects to try an experimental car in New York city some time this month.

PERSONAL.

Mr. W. N. Habliston, general manager, and Mr. A. Langstaff Johnson, chief engineer of the Richmond, Va., Traction Company, expect to attend the Montreal convention.

Mr. Burt Hubbell, secretary and treasurer of the Keystone Telephone Company, Pittsburgh, visited New York the early part of this week and made a welcome call at the ELECTRICAL REVIEW office.

Mr. H. M. Byllesby has been a visitor in New York city for several days past. Mr. Byllesby is one of the most popular and well-known gentlemen in the electrical field, and possesses many scores of friends in all parts of the country.

Mr. C. B. Fairchild, for a number of years the chief of the editorial staff of the *Street Railway Journal*, has resigned active editorial work, but will still be a contributor to the columns of our esteemed contemporary. Mr. Fairchild is very well known all over the country and his many friends, including the ELECTRICAL REVIEW, will wish him full success in whatever field of labor he may now enter.

SPECIAL TRAIN—ROUND TRIP TICKET—NEW YORK TO MONTREAL.

THE MONTREAL STREET RAILWAY CONVENTION.

COMPLETE ARRANGEMENTS—A GOOD EXHIBIT—SOCIAL FEATURES.

THE STREET RAILWAY EXHIBIT.

The exhibition promises to be a most interesting and successful one. All the available space is now engaged. The Victoria Rink has been secured for two weeks beginning October 9 and ending October 22, so that exhibitors will have ample time to erect and remove their exhibits. The building will be in charge of Mr. Stonewall Jackson, whose address is 17 St. Sacrament street, Montreal, P. Q.

PROGRAMME.

The following committees are expected to present reports at this meeting: Standards for Electric Street Railways; Insurance; Patents; Brake Shoes. Papers on these topics are announced: Freight, Express and Mail Service; Feeder Systems; Car Heating; Roadbed Construction.

The social features of the meeting have not yet been finally arranged, but the well-known hospitality of Montreal people is sufficient to insure the delegates to the meeting all the good times and good things they can attend to. The banquet will take place at the Windsor, on Thursday evening, October 17.

THE SPECIAL TRAIN.

Through arrangements made by the New York Central Railroad, passengers on the special train to the Montreal convention, who start from New York city, will not have to bother with return certificates but can purchase round-trip tickets for the one price of $13.35. This will be quite a convenience and will obviate what has always been an annoying feature of these reduced-fare trips. It was possible to do this as the entire trip is made over the line of the Central road and the train is run as a special.

Passengers who start from other points will secure certificates as formerly.

Special train passengers can thus remit to Mr. M. C. Roach, 413 Broadway, N. Y., the amount of the round trip — $13.35 — and Wagner berth—$2—and secure tickets by mail or messenger.

All who contemplate going and who have not secured accommodations should write Mr. Roach at once.

RETURN TRIP.

The return trip of the special train promises to be a particularly interesting and enjoyable one. The train, it is expected, will leave Montreal early Friday and arrive at Saranac Lake before noon. The party will stop at the Riverside Inn. A tallyho drive will be taken around the lake, and a special local train will take the party from Saranac to the beautiful Lake Placid. A reduced fare of one-half only will be charged. In the evening, after dinner at the Riverside Inn, the special train will start for New York city, arriving here about 7.30 o'clock Saturday morning. The committee have certainly planned the trip admirably, as it allows the passengers all day Monday in New York city, and after a four days' visit to Montreal and the attractive Adirondack region, the special returns to New York in time for a full day—Saturday—at the close of the week. The New York Central people are specially interested in making this train a thoroughly pleasant one. Every passenger should have his name recorded by Friday of this week—earlier, if possible.

THE WESTINGHOUSE GAS ENGINE.

AN INTERVIEW WITH MR. GEORGE WESTINGHOUSE, JR., IN REGARD TO IT.

When a representative of the ELECTRICAL REVIEW learned that Mr. George Westinghouse, Jr., had developed a new type of gas engine he went to Pittsburgh and on Friday last had an interview with Mr. Westinghouse in regard to it. In an enthusiastic and impressive way Mr. Westinghouse asserts that he regards this new engine as a most important development and one that will have a wonderful bearing on the economical generation of electric current. It is expected that over half of the 90 per cent loss which now exists between the coal pile and the generator, where steam is the motive power, will be saved by the use of the Westinghouse gas engine. It is estimated that by installing an electrical plant driven by gas engines, the Manhattan Elevated Railway, of New York city, can make a saving of over $500,000 a year in the operation of its lines.

Mr. Westinghouse has for a long time possessed the ideas which have now been successfully developed by his efficient staff of engineers and mechanics in this engine. At the new Westinghouse shops in East Pittsburgh three engines have been constructed and a fourth, of 100 horse-power, is now being erected. Plans are already being prepared for a 500 horse-power engine. In Europe, gas engine manufacturers guarantee one horse-power from three-fourths of a pound of coal; results already obtained from the Westinghouse engine justify the expectation that much better results than these will be obtained from the larger sized engines.

Business men and engineers in Pittsburgh, with whom the ELECTRICAL REVIEW representative talked, are carried away with the new engine and those few who have seen it are even more enthusiastic than Mr. Westinghouse himself.

AN IMPROVED PORTABLE PHOTOMETER.

(*Concluded from Page 201.*)

The screen being colored pale blue and the diaphragm pale yellow, there is no difficulty in obtaining disappearance of the hole in the diaphragm when illuminated by arc light or even by daylight. The selection of the colors suitable for obtaining a true measurement is based upon the mean of a number of measurements. White screens are used, and the comparison should be made in a building illuminated by a number of arc lamps. A number of measurements are made with quick oscillations of the handle, and the mean is taken. Several screens and diaphragms of different tints being in readiness, pairs are tried, and a selection is made of a pair which give a good color match,* and, if possible, the mean reading given by the white screens. A slight departure from the mean could be corrected by the use of a coefficient. It is not suggested that strongly colored lights can be scientifically compared in this manner, but only that the yellowish light of a glow lamp may be compared with the whitish light of an arc or of subdued daylight. We employed this device in 1884, and Messrs. G. W. and M. R. Patterson, the translators of Palaz's "Industrial Photometry," who have used it in connection with a Lummer-Brodhun photometer, remark† that it "can, of course, give no additional absolute accuracy to the photometric measurements. It, however, adds greatly to the comparative accuracy of the results, as it makes it possible to measure relative intensities under various conditions with great precision." But it should be observed that the selection of the tints may be made at leisure and under favorable laboratory conditions, and by thus avoiding all color trouble during ordinary use of the photometer a very considerable gain in precision is secured.

The scale is five and one-half inches (137 millimetres) long, and is shown in Fig. 3. With the smaller of the two lamps the highest reading is equivalent to one candle at a foot; with the larger lamp it is twice this illumination. The oscillations of the handle generally extend at first over two scale divisions, and after three or four oscillations their amplitude may be reduced to about one scale division. The half of a scale division may be estimated, except at the highest part of the scale, which is slightly contracted. The precision is about two to three per cent. The contraction of the scale at the upper end is intentional, and is caused by the arrangement of the levers.

In case of renewal of the lamps it is very important that other lamps should be placed in exactly the same optical position in the photometer, otherwise the scale would have to be recalibrated. In order to fix the height of the lamps, which is the only adjustment necessary, a sheet metal screen, shown by dotted lines in Fig. 1, is placed in a holder attached to the floor of the photometer. Two small holes are drilled in this screen, and a white paper screen, having a black horizontal line, is fastened to the end of the box (see Fig. 1) opposite to the lamps. The hinged screen being lifted by the levers out of the way, "pin-hole images" of the filaments are thus thrown on to this screen, and the lamps being set so that the single horseshoe filament appears nearly closed up (see Fig. 2), the dark line between its two limbs is made to fall on the black horizontal line. The images being magnified, considerable accuracy is possible.

Although the principal object of this photometer, as of those which preceded it, is the measurement of illumination, it is sometimes desirable to measure the candle-power of a lamp in a street without removing it from its position. By the use of a graduated arc such measurements can be made with the present photometer. A quadrant is fastened to the side of the photometer, and a pin at the center from which the quadrant is struck acts as a gnomon. A spirit level on the top of the instrument being adjusted, the angle of incidence may be read in degrees on the quadrant, and at the same time the cosine of this angle may be read on an adjacent scale. It is necessary to find the slant height or direct distance from the source of light to the photometer.

To measure the vertical height of the light, set the photometer so that the shadow falls on 45 degrees. Measure the distance from the pin to the lamp horizontally, and from the pin to the ground vertically. The sum of these distances is the height of the actual source of light. This can be measured to about two per cent, say three inches in 12 feet six inches.

To find the slant height at any distance, the height of the light being known, divide the height of the lamp above the photometer by the cosine of the angle of incidence; the quotient is the slant height required. Or the horizontal distance may be measured and the square of this distance added to the square of the height of the light. This gives the square of the slant height.

To find the candle-power, the illumination in units of a candle at a foot being observed, the light from other lamps being carefully screened, the slant height being known, multiply the illumination by the square of the slant height and divide by the cosine of the angle of incidence.

On hilly ground it is necessary to know the height of the lamp above the photometer at each point of measurement. It is best, in that case, merely to record the angles, and afterwards to find the tangents. The horizontal distance between the photometer and the lamp-post, divided by the tangent, gives the required height. It may be observed that when the square of the slant height in feet is equal to the cosine of the angle of incidence, the scale graduated in units of a candle at a foot becomes a scale of candle-power, and when the square of the distance in feet is 10, or 100, or 1,000 times the cosine, the multipliers 10, 100, or 1,000 may be used to convert it into a scale of candle-power. The square of the slant height being known, the photometer may be tilted until the required cosine is indicated by the shadow of the pin. If the slant height is measured by the sum of the squares of the horizontal distance and the height, the square is at once obtained.

We have calibrated our photometers either by standard candles, or by substandard glow lamps supplied from secondary batteries, or by the amyl-acetate standard lamp or Hefner unit. This standard, which is well recognized in physical work, is 0.877 of a standard candle, or a standard candle is 14 per cent more than an amyl-acetate lamp. Placed at one foot distance from, and perpendicular to, the diaphragm, the photometer being placed on its side, the illumination is 0.877 of a candle at a foot. If it is brought to a distance of 11¼ inches ($\sqrt{0.877}$ feet), it is equivalent to one candle at a foot. But this distance and position is inconvenient. If it is placed at a distance of one foot, and at an angle of 55° 10′, the illumination on the diaphragm is one-half of a candle at a foot, since cosine 55° 10′=0.57, and 0.57×0.877=0.5. A mark is therefore made at this angle on the quadrant, and is inscribed, H. U.=½ candle-power.

Considerable experience with the use of small glow lamps supplied from portable secondary batteries has given us great confidence in this kind of secondary standard of candle-power. The battery is always freshly charged before each evening's work, and is discharged for half an hour before use. The lamps are only turned on while an observation is being taken.

The 1893 photometer was arranged to be held in the hand; our 1884 photometer stood on a tripod about two feet six inches from the ground. The street measurements made in 1892 were all made with a photometer placed on the ground, the diaphragm being about six inches from the pavement. The proper height for an illumination photometer is a matter of opinion. When the photometer is placed on the ground, the large number of measurements required for a thorough photometric survey of a street or empty building can be quickly made. For some purposes—for example, in an exhibition or a church—a stand is necessary; the calculations of candle-power then become rather more tedious.

The various observed and computed quantities may be expressed as follow: D = horizontal distance from photometer to lamp-post (see Fig. 4); L = slant height from photometer to light; H = height of light above the ground; h = height of the photometer diaphragm from the ground; θ = angle of incidence; c/f^2 = illumination of units of a candle at a foot; $c.p.$ = candle-power.

$$H - h = D \times \tan \theta.$$

$$L = [H - h] \times \cos \theta.$$

$$= \sqrt{D^2 + [H - h]^2}.$$

$$c.p. = \frac{c/f^2 \times L^2}{\cos \theta}.$$

The following is an example of the measurement of the illumination and candle-power in the case of a street-lamp.

D	θ	c/f^2	$\frac{\tan}{\theta}$	$\cos \theta$	$\frac{H-}{h}$	H	L	L^2	$\frac{c/f^2}{\cos \theta} \times$	$c.$ $p.$
20	deg 66	0.025	2.25	0.407	8.9	11.9	21.8	475	0.0614	29

The Montreal Street Railway Convention as Viewed in New England.

The interest in the coming convention of the American Street Railway Association, to be held in Montreal during the coming month, is steadily increasing in this section, and the prospects are that there will be a larger attendance from New England than ever before. Aside from the men directly interested in street railway work, there will be a large representation of the kindred and allied industries, and many have expressed their intention of being present who have not made a practice of attending similar gatherings in the past.

There is no question but that New England offers the most prolific field for electric railway development of any section of the country, and should receive a good share of the attention of those interested in this line of work. This is particularly the case with suburban roads, the thriving suburbs of the larger business centers holding so many inducements to home seekers, when efficient rapid transit is furnished, and the close proximity of the bustling little towns through the interior making short lines of connecting roads a profitable investment.

Then, again, the well-known conservatism of New England people, while sometimes, it must be confessed, carried to extremes, is on the other hand a benefit in reducing the number of wildcat schemes and stock jobbing operations which have proved so detrimental to the legitimate extension of electric roads in other sections of the country.

There is considerable activity in railroad circles at the present time, and nowhere are public enterprises more appreciated than here. It is hoped and expected that the coming convention will show many new things of merit as a result of the labors of the past year, and that those who attend for the purpose of learning something of real value in their particular line of work will have no cause to feel dissatisfied with the result.

There has in the past been an underlying feeling among the trade at large that these conventions were more in the line of a grand, good blow-out and general jollification than a serious meeting of men anxious to improve themselves and their methods by contact with other men engaged in a similar line of work, and by the ideas and knowledge acquired, advance their chosen profession along the line of development.

This idea of an annual meeting of such importance as that of one of the leading associations of the country, is altogether wrong, and should be promptly stamped out by the members of the association themselves. The noisy and boisterous element, of which there is bound to be some in every gathering, are learning by hard experience that they are looked upon with little favor and less attention, and that to the earnest and capable man of business, their room is preferable to their company.

The object of these conventions and the aims they tend to promote are worthy of the heartiest support, and where they are honestly carried out, the support will not be lacking.

Boston, October 5. H. G. T.

A Large Flywheel Bursts.

A 50-ton flywheel in the station of the Hudson County Electric Light Company, Hoboken, N. J., burst last Saturday morning. One man was killed and two were injured. It is supposed that some accident occurred which caused the engine to race. The loss was $9,000.

The council of Albert Lea, Minn., has ordered a contract with the Albert Lea Electric Company for 30 1,200 candle-power arc lights for the streets, to be run all night, the price being $75 per lamp per year, the city to have the City Hall and pumping station lighted free. The contract is for five years, the city to have the privilege of terminating it at the end of any year.

* Owing to the Purkinje effect, an exact color match cannot be maintained throughout the whole range. The holes in the diaphragm look yellowish under strong illumination and bluish under feeble illumination.

† "A Treatise on Photometry." Palaz. American translation.

Improved Overhead Equipment for Electric Railway Construction.

Although the electric railway has a well recognized commercial existence of some eight years, yet it is only within the last two years that the great importance of superior overhead equipment has been generally appreciated.

While the most careful investigation has been given to the power plant and motors, the line material has been sadly overlooked. Anything has seemed to answer, with the result of the "lowest bidder getting the contract." We find to-day hundreds of roads where it is necessary to rebuild the entire line, after two to four years' use, where, by the use of first-class material, no such work would have been necessary for 10 years or more. No matter how much current is generated, or how carefully the sizes of wire are determined, if the insulators are improperly made there will be leakage, waste of current and breakdowns. Good insulators are expensive to make, but are cheap at any price. A cheap line will last but a short time and is a constant source of trouble and expense as well as danger.

The Fiberite Company, Mechanicville, N. Y., manufacturers of the Medbery specialties, realized the importance of having a high grade of material, and some four years since organized for the purpose of furnishing such material. With a knowledge born of large experience in this particular line, Mr. Medbery was able to devise equipment which is now considered "standard" on a large number of the leading roads in this country and Canada. No expense has been spared in equipping one of the most perfect electrical supply factories in the world with sufficient facilities to fill all orders on time.

In general appearance the Medbery is not unlike some other makes, but there the similarity ceases. The insulation is a composition invented by Mr. Medbery, after years of experiments. It is hard, strong, tough, acid and waterproof and impervious to the weather. Its insulating qualities are claimed to be unequaled. The metal parts are of aluminum bronze, acknowledged to be the best material for such purposes.

From the illustrations, which are given herewith, of a few of the devices made by the company, it is apparent that the "Medbery" is a thoroughly high-class material.

Figs. 1 and 2 show the standard and West End types of straight line hangers. In both of these the metal parts protect the insulation from any blow of the trolley wheel.

Fig. 3 is the Globe strain insulator which is made in three sizes. One of the large sized Globe strains was tested by Professor Morton, of Stevens' Institute, and showed a resistance of 350,000 megohms and a breaking strain of 6,700 pounds. In almost all cases this insulator will answer the purpose wherever a strain insulator is needed. In the case, however, of unusual strains, or in large cities, where iron poles and heavy span wires are used, and where there is a constant, intense jarring strain, it has been found advisable to use the Brooklyn strain, Fig. 4.

This device is both a turnbuckle and insulator and will safely stand a strain of 12,000 pounds, and a larger size 18,000 pounds.

Figs. 5, 6, 7 and 8 show the feed-wire insulators. Figs. 5, 6 and 7 being used largely in cities, where a heavy feeder is carried. These devices will carry a 500,000-circular mil cable, or one, one and one-quarter and one and one-half-inch cables.

Fig. 9 shows a car house insulator of unusual strength. This insulator is used in car barns of the North and West Chicago roads.

Fig. 10 is the improved trolley frog having no depressions and giving a smooth running surface for the wheel. This frog is strongly made and will not buckle.

Fig. 11 is a circuit breaker used altogether by the Chicago city and other roads.

Figs. 12 and 13 show the quick-break and slow-break switches which, although but lately brought out by the company, have already taken the front rank in the trade. It is impossible to make better switches than the "Medbery." The utmost care has been taken in the mechanical and electrical construction of these switches and their high quality is acknowledged.

Fig. 14, the Medbery "Pony" switch, is a low priced switch gotten out in 15, 25 and 35 amperes, and is a very superior article. It has a polished slate base, and the clips are so constructed that they cannot twist nor become out of line. Connection can be made from the back or side. The workmanship is superior in every way, and it is constructed upon principles of durability and effectiveness.

FIG. 1. FIG. 2. FIG. 4.
FIG. 5. FIG. 3. FIG. 6.
FIG. 7. FIG. 9. FIG. 14.
FIG. 10. FIG. 8.
FIG. 11.
FIG. 12. FIG. 13.

EXAMPLES OF MEDBERY OVERHEAD MATERIAL FOR ELECTRIC RAILWAY CONSTRUCTION.

One of the most essential features of the Medbery material, and one which goes far to produce its great superiority of economy, reliability, convenience and sightliness, is the great care taken, not only in the manufacture, but also in the testing of all devices before they are allowed to leave the factory.

It would seem that the efforts of Mr. Medbery, have been signally successful. Certain it is that a road equipped with the "Medbery" is not only a "thing of beauty," but it is also absolutely safe and thoroughly reliable.

The Chicago-Waukegan Horseless Carriage Race.

Great interest is being taken in the Chicago *Times-Herald* horseless carriage race which will occur on November 2. The course is almost exactly 100 miles long, extending from Chicago to Waukegan, Ill., and return, and embraces almost every kind of road and thoroughfare. Permission has been obtained from the Chicago city authorities to use the west parks and boulevards as a part of the course. The start will be made from Jackson Park and the finish will be along the lake shore drive to Lincoln Park. The start will be made similar to a yacht race, one or two carriages crossing the line at a time. Each vehicle will be conspicuously numbered. Two persons are the minimum number of passengers to be carried, but the judges will probably make an allowance for vehicles carrying more than this number.

The entries were closed on September 15, at which time 52 persons had entered 63 vehicles of all kinds in competition. A preliminary test of the carriages will be held on October 26, when all types of vehicles which do not merit the further consideration of the judges will be debarred from the final contest on November 2.

A New Electrical Society.

A number of students of the senior class have met and organized the Electrical Society of the College of the City of New York. The following officers have been elected: President, Harold Peyser, '96; vice-president, Edward Kasner, '96; secretary, Rudolph P. Ellis, '96. The object of the society is to continue the study of electricity begun by the present seniors in the junior year and to stimulate the interest in electricity in the junior class. Seniors and juniors are admitted into the society. Each member will in turn deliver a lecture on a subject assigned him. Experiments illustrative of the lectures will be conducted.

A Conclusion of Science.

[*From the New York Sun.*]

Science having declared the inability of an electric current to cause death, a horse walked fearlessly against a dangling wire and was instantly killed. Lamenting, his owner sought to rescue the carcass, and was also killed. Science, noting the blunder of the two, said: "They perished in their ignorance."

HOW SHALL WE HEAT OUR CARS?

READ BEFORE THE NEW YORK STATE STREET RAILWAY ASSOCIATION, SEPTEMBER 17, 1895, BY J. F. McELROY.

(Concluded from page 190.)

The diagram, Fig. 3, has been made from tests in which the temperature at the grated openings has been taken very carefully with thermometers placed against the grated openings, but not within the heater case. This would indicate the temperature in front of the heater openings and at points where the clothing of the passengers might possibly touch. I introduce this to simply show that the highest temperature in the air that is reached is about 180 degrees Fahrenheit. This being the temperature of heated air, it is evident that its effects upon either the clothing or limbs of passengers could not be in any way dangerous or disagreeable. This is due to the free discharge of air up through the heater by which the heat, as fast as it is generated, is carried into the car. A curve is also shown, which is not the curve of temperature of the air discharged from the heater, but is the temperature recorded by thermometers placed within the heater case and within one-half inch above the wire coils. The upper curve indicates the curve of temperature of the porcelain itself, and is obtained from the readings of the thermometer placed within the hollow openings of the porcelain. I desire to call your attention to the forms of these curves both when the temperature rises when heat is first applied, and to the temperature of the curve obtained when heat is shut off. It is seen that the temperature of the porcelain rises rapidly and the temperature also descends rapidly when the circuit is open.

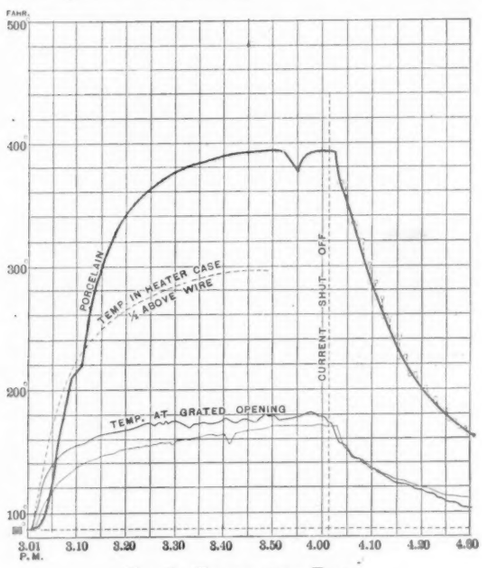

FIG. 3.—TEMPERATURE TESTS.

I now desire to call your attention to the conversion of electrical energy into heat.

The last 50 years have witnessed changes in popular notions on many points. Two great scientific theories, unknown in the early part of this century, have in recent years been accepted as a part of our scientific faith. They have assumed control of the scientific mind in all questions involving phenomena of matter and force. I refer to the conservation of matter and the conservation or persistence of force. According to the first theory we believe that all matter now existing has always existed in its elements and that these elements are indestructible. According to this theory we believe that the carbon which unites with the oxygen of the air in the process of combustion of the carbon is not destroyed, but exists with the oxygen in the form of carbonic acid gas, and that when this gas enters into the growth of plants the carbon is separated from the oxygen and may be restored to us again as free carbon.

The next theory is that of the conservation of force, according to which we believe that energy is wholly converted in every translating device. In other words energy is indestructible. It cannot be annihilated. It is true in most of the applications of force in the operation of machinery that the efficiency of the apparatus is less than 100 per cent; that is to say, less energy in one form is delivered by a machine than what is delivered to it. This is because translating devices usually convert energy into several forms and therefore any one form of energy contains less than the whole. Electricity being a form of energy, we may say that electrical apparatus generally transforms into the desired form of energy less than 100 per cent. Now, if the theory of the conservation of force is true, all of the energy can be accounted for in some way. Let us examine for a moment the forms of energy into which electrical energy may be converted. We have, first, mechanical motion; second, chemical action; third, light; fourth, magnetism, and fifth, heat. This list, I believe, comprises all possible forms of force into which electrical energy may be transformed. By reference to the table, Fig. 4, I have attempted to show you some of these transformations. In these cases I have assumed that we transform 100 units of electrical energy by different devices. For example, in the process of electrolytic decomposition the object is to produce a chemical action in the electrolyte. This we may assume to be a solution of sulphate of copper in a vessel in which are copper electrodes. When we send a current of electricity through this electrolyte there is a considerable resistance offered. This means that a certain part of the energy of the electric current is transformed into heat in the electrolyte. This heating effect takes place absolutely independent of the chemical action, and consumes a certain part of the electric energy. The proportion of the electric energy so employed which is transformed into heat depends upon the resistance of the electrolyte, it being very important that this resistance be made as low as possible. As an average condition of the resistance of electrolytes, I find that about 50 per cent of the electric energy employed in electrolytic decomposition is transformed into heat in overcoming the resistance of the electrolyte itself, and the remaining 50 per cent is transformed into chemical action. Out of 100 units of electrical energy employed in the operation of electrolysis, we find that no mechanical motion is produced, chemical action 50 per cent, no light, no magnetism and 50 per cent of heat is produced, or a combined total efficiency of 100 per cent. If we take the electric motor, we find that it is impossible to build an electric motor without resistance, and when a current passes through this motor we always obtain heat. Therefore, in 100 units of electric energy which is transformed in the motor, 90 per cent, approximately, may be transformed into mechanical motion—no chemical action is produced, no light—two units transformed into magnetism and eight units in the form of heat, giving us a total of units of energy in these different forms of force of 100, or exactly equivalent to the number of units of electrical energy with which we started. If now we consider the incandescent electric lamp, and transform 100 units of electrical energy, we find no mechanical motion is produced, no chemical action, about five per cent in the form of light, no magnetism, and 95 per cent of heat. Of course it is apparent that the so-called efficiency of each of these transformations depends upon the useful work which we are endeavoring to produce with the electric current. If it is the electric motor, 90 per cent is realized; if the incandescent lamp, five per cent, although, if we were using the incandescent lamp as an electric heater, we would call its efficiency 95 per cent instead of five per cent. We then come to the transformation in an electric heater. Again, we will employ 100 units of electric energy. We find that there is no mechanical motion, there is no chemical action, no light, no magnetism. Heat, therefore, must be the only form of energy into which the 100 units of electrical energy have been transformed. The electric heater, then, is the only case that comes within our knowledge where 100 units of electric energy may be transformed into 100 units of any other one form of force. We can then establish the heat equivalent of the electric current for all electric heaters in which no disintegration takes place in the resisting conductors, as one British thermal unit (one pound degree Fahrenheit) is produced by 1,047 watts of electric energy. I speak of this quite at length for the reason that we are constantly meeting with business men, as well as so-called inventors of electric heaters, who claim that some particular form of electric heater which they have devised will produce a greater amount of heat per unit of electric energy than some other form of heater. This is plainly impossible, so long as neither mechanical motion, chemical action, light nor magnetism are produced in the electric heater. Transformation of electric energy is, therefore, entirely into heat with an efficiency of 100 per cent. It is true that in some of the forms of electric heaters a chemical action, resulting in the destruction of the heater, is produced by the electric current. Where chemical action takes place the chemical action can be determined in units of energy. The efficiency, then, of that particular heater must be 100 per cent, minus the amount so transformed into chemical action. But where we have the wires of electric heaters running year after year without any change of any kind appearing in these wires, it is evident that the efficiency may be regarded as 100 per cent.

Mechanical motion.		90		
Chemical action...	50			
Light.....			5	
Magnetism.....		2		
Heat.....	50	8	95	100
Total.....	100	100	100	100

FIG. 4.—FORMS OF ENERGY INTO WHICH ELECTRICAL ENERGY MAY BE CONVERTED.

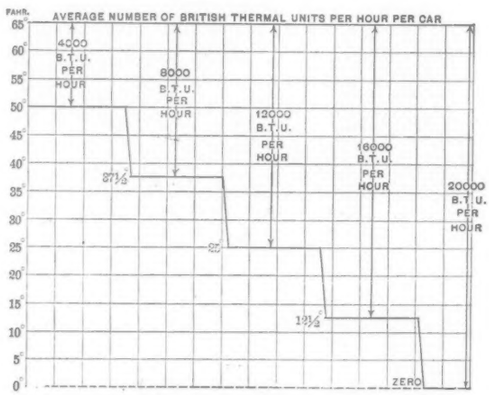

FIG. 5.—SHOWING AMOUNT OF HEAT NECESSARY TO HEAT A CAR AT DIFFERENT TEMPERATURES.

The fixed relation between electric energy and heat makes it easy to determine the amount of electric energy which is equivalent to a unit of heat. Careful tests have determined upon 1,047 watts as equivalent to one British thermal unit, or one pound degree Fahrenheit. Therefore, it becomes an easy matter to determine the exact amount of heat which is produced in electric heaters when the consumption of current is known. For example, if we find the number of watts, by multiplying the number of amperes passing through the heater by the difference of voltage of the heater terminals and then divide the number of watts by 1,047, we will have for a quotient the number of British thermal units of heat generated in the electric heater per second. If we consider the electric heaters in a car to be using as a maximum 12 amperes of current on a 500-volt circuit, we will find that 12 amperes of current multiplied by 500 will give us 6,000 watts. Dividing 6,000 watts by 1,047, we obtain 5.73 British thermal units of heat generated in the car per second. Multiplying 5.73 British thermal units by 60 will give us 343.8 British thermal units per minute. This is equivalent to 20,628 British thermal units per hour; or, since a British thermal unit is the amount of heat necessary to raise one pound of water one degree Fahrenheit, the heat generated would be equivalent to the raising of 20,628 pounds of water one degree Fahrenheit per hour. In this way, with a given consumption of current, it is very easy to determine exact values in heat units, or if we know what heat units are required, it is a simple matter to ascertain the exact consumption of electric energy necessary to produce this amount of heat by means of the electric heater. I think that practical experience in the heating of cars has demonstrated that it

requires about 20,000 British thermal units per hour to properly heat an 18-foot car in the latitude of New York State in the coldest weather, and that this amount of heat should be provided as a maximum. The average requirement during the months of the Winter when heat is used would not exceed one-half of this amount or would be approximately 10,000 British thermal units per hour.

The amount of heat required, however, differs somewhat, according to the construction of cars, to their exposure to winds on the lines where they are run and to the care exercised by conductors in closing the doors promptly when passengers enter or leave the cars. All of these are points which affect materially the temperature which will be maintained in a car with a fixed amount of heat. Also the number of people in a car affects quite perceptibly the amount of heat required. Crowded cars require less heat to maintain a given temperature than is the case with cars carrying but few passengers, due to the amount of heat given off from the bodies of passengers. Experiments have been made as to the effect of passengers upon the temperatures of cars and houses. It has been found that each person gives out 191 British thermal units of heat per hour. When we compare this amount with the average amount of heat required during cold weather, we find that the heat given out by 52 persons will maintain the same temperature in the car as is required on the average during the Winter months. This point has a practical bearing in the heating of cars, in that, if a car is heated uniformly as with a stove, it would be found overheated during those hours of the day when the cars are filled with passengers. Where electric heaters are used some roads have established the practice of reducing the heat between certain hours when their cars are filled with passengers. This would still allow a comfortable degree of heat to be maintained in cars at the same time and would allow the use of the extra power for propelling cars at the time when travel is the heaviest. The next point in regard to electric heating is the regulation of temperature. As the temperature of the outside air during the heating season will vary from 50 degrees to 15 below zero, I consider it important that the electric heating apparatus be so constructed that the amount of heat given to the car can be varied so as to meet the demands of the variable weather. This is necessary for two reasons. First, it is necessary in order to maintain a comfortable temperature in the cars with variable conditions in the weather, and second, it is important in order that the consumption of current shall be adjusted to the actual demands. Undoubtedly a great saving in the use of current is brought about by the use of apparatus that is provided with means for proper regulation. This is illustrated by the diagram, Fig. 5, which shows the amount of heat necessary to heat a car at different temperatures. I show you a device which we have extensively introduced for the purpose of regulating the temperature of the cars and by which five different intensities of heat may be obtained, corresponding to consumptions of current varying from 2¼ to 12 amperes. This switch is what is known as the five-point switch and is a device for shifting the heating coils constituting the car equipment into series and multiple series relation to each other so as to vary their combined resistance and hence to vary the flow of current through them. On small cars and in climates where comparatively a small amount of heat is required, we also use an equipment consisting of four heaters instead of six, as in the standard equipment. These four heaters are connected up with what we call the three-point switch, which is so arranged as to place the heating coils in multiple series so as to vary the consumption of current from two and three-quarters up to eight amperes. The details of construction of these switches may be so clearly understood by an examination of them that I will not stop to describe them here. As to the cost of heating cars by electricity, it is evident that the cost is determined by the cost and quantity of current consumed. If the number of ampere hours on a 500-volt circuit can be once determined and the cost of an ampere hour on the same circuit is known, the cost of running electric heaters can be easily ascertained. The question of cost, however, is not easily determined, as it still remains an open question as to just what items should be charged to electric heating. I am inclined to think that it would be but fair for a company considering the advisability of introducing electric heaters in their cars, to consider, not the total proportionate cost of current consumed, but rather the additional cost of generating the current to supply the electric heaters. In other words, it would not seem just to charge to electric heaters such power house expenses as would continue the same provided the electric heaters were not introduced; but instead to charge only the cost of the additional current. These costs have been carefully determined, based upon the cost of producing power by different types of engines as contained in the paper of Charles E. Emery, Ph. D., which is printed in the proceedings of the American Institute of Electrical Engineers for March, 1893. These figures of Mr. Emery's appeared in print some years ago and have been carefully revised to agree with results obtained in the most modern types of engines. The costs are based upon units of 500 horse-power, and so far as the figures by Mr. Emery are concerned, give the cost of horse-power in the engine wheel or jack shaft. I have, then, allowed the efficiency of 90 per cent in the generators and assume an efficiency in the distributing system of 93 per cent, making a combined efficiency of generators and lines of about 82 per cent.

From the reports which we have recently received from the street railway companies in this State I find the average efficiency of the lines of the companies reporting was .923. This so closely confirms my previous estimate of .93 that the figures based on my former estimate are still retained. Corrections can be made upon the figures contained in this table to fit any given case, as it is found that the efficiency of the lines may be greater or less than 93 per cent. (See table, Fig. 6.)

It will be seen from the above table that the cost of operating electric heaters will depend upon the kind of engine employed and the cost of coal. For example: If coal costs $2 a ton of 2,000 pounds, and if the average consumption of current in cold weather is seven amperes, and if we take a compound low speed condensing as the average type of engine in point of economy in consumption of fuel, we will find that seven amperes for one hour will cost 1.17 cents.

From the reports which we have received, I find the average length of time a car is in service per day in the Winter time is 15 hours. The cost of operating electric heaters with the average consumption of current in cold weather would, therefore, be 15 times 1.17 cents, which equals 17.55 cents for 15 hours. This cost does not allow for any depreciation in heaters, as the three years of service of these heaters does not appear to have any effect upon the life of the conductors and not a single coil in any heater has ever been renewed in this length of time. So far as an examination of the coils that have seen three years of service can determine, absolutely no oxidation has been produced upon the wires. Some allowance, however, should be made for repairs, when the amount of necessary repairs can be ascertained.

As to the cost, now, of heating by stoves, I will say that I have a number of reports from different railroads in this State using stoves. The list of questions which I submitted was designed to bring out as full information as possible in regard to the operation of cars equipped with these stoves. Several roads furnished me with reports. Taking the average made in the answers referred to, I find that 33 pounds of coal were used per car per day, costing $4.55 per ton of 2,000 pounds. This coal costs seven and one-half cents per day. The average cost of repairs per car is one-half cent a day. The average cost of dumping fires, removing coal and ashes before car is run out of barn, and coaling up and kindling fire in the morning, including the cost of kindling used and that part of cleaning cars chargeable to stoves, is 10 cents per day. The average cost per day of other expenses chargeable to stoves not included in above, as cost of removing stoves for the Summer, installing of the stoves in the Fall, repairing of head linings, repainting, etc., average one and one-quarter cents per day. Without adding anything to the cost of the stove for the space for one person occupied by the stove, I find that the total of the items so far aggregates 19¼ cents per car per day. It has already been stated that the extra cost of current based upon the cost of power necessary to heat a car with seven amperes of current on a 500-volt circuit aggregates 17.55 cents per car per day. This amount will be modified as different types of engines are used of different efficiencies, but I believe that on the average, for the type of engine generally used, it is correct. Other questions, of greater importance, however, than the cost of the mere heating by electricity or stoves, which is as to the effect which electric heating has in inducing travel upon street car lines. It is, however, a difficult thing to determine in figures exactly what increase of travel takes place on account of having cars properly heated at all times and that heat being properly distributed through the car. I am not at this time prepared to give any figures or estimates based upon this point. I believe, however, that it is worthy of the consideration of managers of street railways in the matter of securing patronage for their lines.

FIG. 6.—TABLE SHOWING FUEL AND OTHER COSTS OF ELECTRIC CURRENT ON A 500-VOLT CIRCUIT, AND THE FUEL COST OF OPERATING AN ELECTRIC HEATER IN FIVE DIFFERENT POSITIONS OF TEMPERATURE REGULATING SWITCH.

TYPE OF ENGINE.	Indicated horse-power to produce 500 net horse-power on high-speed engine shaft, or jack-shaft of low speed engine.	Gauge steam pressure.	Pounds of coal per indicated horse-power per hour.	Total cost in cents of one ampere-hour on 500-volt circuit delivered at the car, including coaling, engineer, fireman, supplies, repairs, water, insurance, taxes, renewals and eight per cent interest on the investment.	Cost of coal per hour in cents for heating a car with Consolidated Car Heating Company's equipment of six electric heaters on a 500-volt circuit, when switch is placed in different positions, as follows:				
					Intensity 1 Uses 2.14 Amperes.	Intensity 2 Uses 2.88 Amperes.	Intensity 3 Uses 6.98 Amperes.	Intensity 4 Uses 8.09 Amperes.	Intensity 5 Uses 12.05 Amperes.
					Coal at $2.00 per 2,240 lbs.	Coal at $2.00 per 2,240 lbs.	Coal at $2.00 per 2,240 lbs.	Coal at $2.00 per 2,240 lbs.	Coal at $2.00 per 2,240 lbs.
Simple high-speed non-condensing	542	100-120	3.882	.84	.64	.86	2.01	2.43	3.62
Simple low-speed non-condensing	556	100-120	3.412	.78	.57	.78	1.89	2.19	3.26
Compound high-speed non-condensing	542	100-120	3.059	.74	.50	.68	1.64	1.91	2.85
Special triple-compound high-speed non-condensing	542	150-170	2.824	.72	.47	.63	1.52	1.77	2.63
Simple high-speed condensing	542	100-120	2.588	.68	.43	.58	1.40	1.62	2.41
Simple low-speed condensing	556	100-120	2.353	.61	.40	.54	1.30	1.51	2.24
Compound high-speed condensing	542	100-120	2.353	.66	.39	.52	1.27	1.47	2.20
Compound low-speed condensing	556	110-125	2.118	.62	.36	.48	1.17	1.36	2.03
Special triple-compound high-speed condensing	542	150-170	2.000	.62	.33	.44	1.08	1.25	1.86
Triple-compound low-speed condensing	556	150-170	1.882	.60	.32	.43	1.04	1.21	1.80
Triple-compound low-speed condensing	556	160-170	1.765	.59	.30	.40	.98	1.13	1.69
Ditto for probable maximum results	556	160-170	1.474	.59	.25	.33	.81	.91	1.40

NOTE.—The heater is usually operated at intensity 3, which meets the requirements of outside temperatures between 20 degrees and 30 degrees Fahrenheit.

Trimming Lamps On a Bicycle.

The municipal lighting plant at Edinburgh, Scotland, furnishes current for 150 arc lamps for street lighting. The turning out of these lights, which are on the same mains as the incandescent lights, was done by hand. The time formerly occupied was nearly two hours, when the attendant went around on foot. But a man is now sent on a bicycle, and does the work in half an hour. The city finds that by thus lessening the time of unnecessary use of current and consumption of carbons it is saving $200 worth of electricity every year.

ADVANCE INFORMATION.

VALUABLE INFORMATION FOR MANUFACTURERS AND DEALERS.

We publish below the earliest information obtainable relating to new electric railways, new electric light companies, new telephone companies and projected electric construction of all kinds. Every reader will find these columns of special interest, and manufacturers and supply houses will receive many valuable suggestions looking to new business by carefully watching this department in the ELECTRICAL REVIEW from week to week.

New Electric Railways.

STROUDSBURG, PA.—The Delaware Valley Electric Railroad Company has changed its name to the Delaware Valley Railway. The amount of capital stock was made $300,000. The president of the new road is now Dr. J. H. Shull, and the directors are John M. Hill, M. F. Coolbaugh, A. W. Loder, E. F. Peters, J. Ottenheimer, F. W. Eilenberger, T. Y. Hoffman and Jesse Ransberry.

CROTON, N. Y.—The Croton Valley Electric Railway Company has been incorporated to construct a narrow gauge street surface railroad, about four miles long, from the New York Central depot in Croton-on-Hudson to the new Cornell Dam. Capital, $10,000. Directors, Charles E. Grattan, Edward White, Robert B. Wright and others, of Croton-on-Hudson.

GALESBURG, MICH.—The Owosso street railway is soon to be operated by electricity.

JACKSONVILLE, FLA.—The Jacksonville Street Railroad Company will supply the public with electric lights and power.

AKRON, OHIO.—A number of local capitalists are about ready to form a company for the purpose of building an electric line from this city to Massillon, by way of Turkey Foot Lake. It would connect the street railways north of this city, the principal one being the A., B. & C. line, with the lines in and about Canton and Massillon.

LYNCHBURG, VA.—The Lynchburg & Rivermont Electric Railway Company, of which John P. Pettyjohn is president, may extend its Rivermont division to College Hill suburb.

BELLOWS FALLS, VT.—F. L. Houghston and others, of Brattleboro, are interested in the construction of an electric road from Bellows Falls to Saxton's River.

COLOMA, MICH.—A syndicate has secured a franchise to build an electric line from Coloma to Paw Paw Lake. An electric line is also proposed from Coloma Lake and another to Union City.

DULUTH, MINN.—Duluth Street Railway Company, of which H. Warren is general manager and superintendent, has decided to extend its West Third street electric road to Ironton.

URBANA, OHIO.—W. H. Hanford & Company have been granted franchise to build the interurban electric railway between Urbana and Springfield.

TERRE HAUTE, IND.—The Terre Haute & Brazil Electric Railway Company have been granted right of way to construct an electric road.

SULLIVAN, N. Y.—The Chittenango & White Sulphur Springs Railway Company has been incorporated by Charles F. Pennock, George Walrath, George C. Clark and others to construct and operate a street railway about six miles long in Madison County. Capital stock, $150,000.

MIDDLETOWN, CONN.—The Middletown Street Railway Company has been granted permission to extend its electric road for three miles at an estimated cost of $40,000.

BELVIDERE, ILL.—The Belvidere City Railway Company, incorporated by John M. Roach, James B. Canterbury, Charles E. Fuller, to build an electric road. Capital stock, $35,000.

ST. LOUIS, MO.—The Houseman electric line is to be extended from Brentwood to Creve Coeur Lake.

BURLINGTON, VT.—Steps are being taken to construct an electric railroad.

BOSTON, MASS.—The Milford & Framingham Street Railway have been granted permission to build.

DERRY, N. H.—The Derry & Chester electric road will probably be constructed shortly. All but $8,000 of the amount necessary for its construction has been raised.

CHESTER, PA.—The Media, Middletown, Aston & Chester Electric Company will increase their capital stock from $30,000 to $150,000, for the immediate construction of the road, plans for which are now being considered.

FORT WAYNE, IND.—An electric road to be constructed from Garrett to Auburn.

STONEHAM, MASS.—The Mystic Valley electric street railway is the name of a new electric railway that is to be built from Winchester Center to Stoneham. It will be operated by the Wakefield and Stoneham Electric Railway Company, and among the subscribers are Col. Charles F. Woodward, of Wakefield; James F. Shaw, of Newburyport; Hon. S. W. McCall, and A. B. Coffin, of Winchester, and others. Capital stock, $40,000.

WINTON, PA.—The Archbald Electric Street Railway Company, incorporated by James Kane, as president, to build a road between Archbald Borough, Jermyn and Winton. Capital stock, $30,000.

HUNTINGTON, IND.—The Huntington, Columbia City & Ligonier Electric Railway Company have applied for incorporation. Valorous Brown will be president of the new company; Hon. F. W. McNagny, vice-president; T. R. Marshall, secretary; J. H. Rush, secretary, and George Ruch, general manager.

PEKIN, ILL.—The Richwoods Railway Company, incorporated by Robert M. Cox, James M. Morse and Theo. J. Miller, to construct a street railway through the counties of Peoria, Tazewell and Woodford. Capital stock, 50,000.

SAGINAW, MICH.—The construction of an electric car line between this place and Bay City seems an assured fact.

ELKHART, IND.—President Burnes, of the Indiana electric railway, has awarded the contract for laying the track from here to Milford, Ind., a distance of 30 miles, to the White-Crosby Company, of Baltimore.

BIDDEFORD, ME.—It is expected that between $18,000 and $20,000 will be expended in the improvements of the Biddeford electric road next Spring.

ALBERT LEA, MINN.—A movement is on foot to secure a franchise and put in a trolley line.

DEDHAM, MASS.—A new street railway corporation is being formed at this place. Directors, the Hon. John R. Bullard, Thomas T. Robinson, Dr. John W. Chase, Henry C. Delano, Ferdinand F. Favor, all of Dedham; Francis Doane, of Norwood, and A. A. Whittier, of Boston. The capital stock of the company is $75,000, and the new road will be known as the Norfolk Central street railway.

KANSAS CITY, MO.—The Metropolitan street railway, of which C. F. Holmes is general superintendent, will change its motive power to electricity.

DERRY, N. H.—B. W. Burgett, of Boston, offers to build and equip the proposed Derry & Chester electric railroad for $60,000.

NAUVOO, IOWA.—An electric road between this place and Fort Madison and Keokuk is contemplated.

PORTLAND, ME.—The Parmenter Car Tender Company has been organized for the purpose of owning, selling and acquiring inventions and letters patent relating to street car fenders. Capital stock, $100,000. President, Charles F. Perkins, of Brookline, Mass.; treasurer, Harry W. French, of Lexington, Mass.

BOSTON, MASS.—The Railroad Commissioners granted permission to the Wellesley & Boston Street Railway Company to issue $10,000 stock. This is a new company. The Commissioners gave permission to the Cottage City Street Railway Company to issue $12,000 new stock.

GREENVILLE, PA.—An electric road from this place to Meadville by the way of Conneaut Lake is likely to be one of the enterprises of the near future.

PITTSBURGH, PA.—The contract for the building of the Knoxville, Fair Haven & Mount Lebanon street railway has been let to J. J. Houghton, of Allegheny, the price being $161,000. The road will be about five and one-half miles long. The new line will be operated by the Pittsburgh & Birmingham Traction Company. The officers of the new company are: President, Henry Meuschke; vice-president, Charles W. Provost; secretary, J. L. McKee; treasurer, W. W. Murray. Directors, J. F. Grimes, A. N. Hunter, H. E. Cole and T. E. Renton.

TOWANDA, PA.—The contract for building the Towanda & Canton electric road has been let to A. S. Chapman, of Buffalo. Work is to be commenced in October.

COLUMBUS, OHIO.—The Troy, Tippecanoe & Dayton Interurban Railway Company has been incorporated by Theodore Sullivan, George S. Long, George W. Scott, J. T. Knopp, Phil. J. Gates and others, to build and operate an electric railway between Troy and Dayton. Capital stock, $25,000.

MADISON, WIS.—The Chicago & Wisconsin Inland Lake line, which was recently incorporated, will be an electric road and may be extended to Milwaukee.

HAGERSTOWN, MD.—The Hagerstown & Potomac Electric Railway Company has been organized by E. E. Sponseller, of Harrisburg, Pa.; J. Clarence Lane, of Hagerstown, and Hon. G. M. Culp, of Shamokin, Pa., to build trolley lines from Hagerstown to Funkstown, Penmar and Waynesboro.

HOLLISTON, MASS.—The Milford, Holliston & Framingham Electric Railroad Company has applied for franchise to construct an electric road.

DANVILLE, ILL.—An electric railroad will probably be constructed from Danville to Paxton. Funds are now being raised.

DETROIT, MICH.—A new electric road will be constructed from Detroit to Ann Arbor.

Electric Light and Power.

DES MOINES, IOWA.—The Newton Electric Light Company has been incorporated by B. E. Sunny, James S. Cummings and H. M. Vaughn, to construct and operate an electric light and power plant.

PLEASANT HILL, MO.—Steps are being taken to establish an electric light plant.

CHATTANOOGA, TENN.—The Chattanooga Light and Power Company has an option on a new site. If water can be found the new electric plant will be erected at this point. The entire plant will cost fully $50,000.

MT. PLEASANT, PA.—Mayor Zimmerman, Monroe Morrison, the East End banker, and a number of local capitalists are contemplating the erection of a second electric plant here.

UTICA, N. Y.—The Utica Electric Light Company has been awarded the contract to equip the new mill of the Mohawk Valley Scotch Cap Company with an electric lighting plant capable of supplying 550 lights.

VERGENNES, VT.—The Vergennes Electric Light Company having outgrown their present plant are negotiating with the Vergennes Water Power Company for a new power plant.

CANAJOHARIE, N. Y.—The Central New York Light and Power Company has been incorporated to supply electricity in Oneida and Canajoharie and in places within five miles of those villages; capital, $100,000. Directors, H. Walter Webb and William H. Gelshenen, of New York city; William J. Arkell, of Canajoharie; Judson M. Warner, of Oneida, and Alden M. Young, of Waterbury, Conn.

TRENTON, MICH.—A Detroit syndicate, headed by Harry P. Wickham, has made a proposition to put in an electric light and waterworks plant here.

PLANKINTON, S. D.—F. L. White, of this place, has purchased the electric light plant at this point and set it in operation on October 1.

GREAT BARRINGTON, MASS.—Hugh Sheridan will establish an electric light plant on his own premises.

BUCKLAND, VT.—The Lamson & Goodnow Manufacturing Company is to put in an electric light plant for the purpose of lighting the factory.

HOLTON, KAS.—Steps are being taken to construct an electric light plant.

SALT LAKE CITY, UTAH.—The Big Cottonwood Power Company will erect a new $15,000 electric power house.

NEWTON, IOWA.—Newton Electric Company has been incorporated with B. E. Sunny, president; James S. Cummings, treasurer, and H. M. Vaughn, secretary. Capital stock, $25,000.

HUNTINGTON, N. Y.—Huntington Gas Company has been incorporated by L. B. Gleason, 44 Wall street, New York; W. D. Hard, New York, and Victor Cumberson, Brooklyn, to supply gas and electricity. Capital stock, $60,000.

CLAY CITY, IND.—The Clay City Electric Light Company's power house was destroyed by fire.

BRANFORD, CONN.—The Branford Electric Company, new corporation, will establish an electric light plant, which will supply lights to Branford, Stony Creek, Guilford and Pine Orchard.

PITTSFIELD, MASS.—The Pittsfield Electric Company will extend its electric service.

WILLIAMSPORT, PA.—Citizens' Electric Company has been incorporated with Grant Sweet treasurer. Capital stock, $2,000.

MISHAWAKA, IND.—Citizens' Electric Company has been incorporated with J. A. Roper, president; M. V. Buger, treasurer, to supply electric light and power over five miles of circuit. Capital stock, $25,000.

ALBANY, N. Y.—Articles of incorporation have been filed by the Huntington Gas Company, which proposes to manufacture and supply gas and electricity for light and other purposes. The capital stock of the company is $60,000. Directors for the first year are L. B. Gleason and W. B. Hard, of New York city, and Victor Cumberson, of Brooklyn.

NORTH EAST, PA.—A new electric light and power plant will be established here.

NORWICH, CONN.—Amos. C. Swan, the electrician for the firm of Eaton, Chase & Company, is now engaged in placing an electric plant in the hotel at Stafford Springs. Power will be furnished for 200 lights, a large annunciator and call bells. Mr. Swan will soon begin to put

a large electric plant in the Hopkins & Allen industry on Franklin street. The building is to be wired for 400 lights of 16 candle-power each.

New Telephone and Telegraph Companies.

NORTH MANLIUS, N. Y.—D. J. Dewey and D. D. Costello have signed a contract guaranteeing $7,500 for a telephone here. It will be located at the post office.

TREMPEALEAU, WIS. — Negotiations are about completed for the building of a new telephone line from this city to Centerville, five miles distant, which will connect with the Luce-Veitch line, the Northwestern Telephone Company and the long-distance telephone to Chicago and the East.

FORESTVILLE, N. Y.—The N. Y. & P. Telephone Company is going to extend its line from Sheridan to this place.

MILWAUKEE, WIS.—A franchise has been granted to the Baraboo Telephone Company to put in an exchange.

TAUNTON, MASS.—The contract for furnishing the cables for the Southern Massachusetts Telephone Company has been placed with the Western Electric Company.

COLUMBIA, S. C.—A Western Union telegraph office has been established at Little Mountain, on the line of the Columbia, Newberry & Laurens Railroad.

CORPUS CHRISTI, TEX.—The Alice, Wade City & Corpus Christi Telephone Company will extend its line to San Diego and Santa Gertrude's Ranch immediately.

AUSTIN, TEX.—The Beaumont Telephone Company, domicile, Beaumont, Texas, has been incorporated to construct telephone lines and establish exchanges in Jefferson, Hardin, Tyler, Jasper, Orange, Liberty, Harris and Galveston counties. Capital stock, $10,000. Incorporators, E. L. Bacon, J. F. Keith, Minnie King.

VOSSBURG, MISS.—Captain C. W. Gallagher, of Meridian, representing the Standard Telephone, closed a contract with some of the leading citizens of Vossburg and Paulding to build a telephone line from this place to Paulding.

PENN YAN, N. Y.—A local firm has just secured a franchise from the Board of Education to erect and operate a telephone system throughout the county, and soon after it will be extended into Ontario County and then be connected by wire to Buffalo, Chicago, New York and Elmira.

PIKE, N. Y.—The telephone line between this place and Hume will be extended to Centerville.

JACKSON, MISS.—A company is now being organized to connect Durant, Goodman, Pickens, Ebenezer and Yazoo City by a telephone line.

GRAND RAPIDS, MICH.—The Local Telephone Company is contemplating building a new telephone line to this place and Detroit.

UNIONTOWN, PA.—The directors of the Farmington Telephone Company have completed arrangements for the line to be extended to Gibbon Glade, *via* Elliottsville. The contract for furnishing the poles was awarded to C. W. Leib. The line is to be completed by October 15.

DETROIT, MICH.—The Automatic Telephone Exchange, Limited, with a capital stock of $1,000,000, has been incorporated. The capital stock is represented as fully paid in by letters patent for the Gates Automatic Telephone Exchange, the value of which is placed at $1,000,000. The object of the incorporation is the manufacture, selling and leasing automatic telephone exchange apparatus. The stockholders are Charles A. Gates, of Saginaw, chairman; William Rebec, of Saginaw, vice-chairman; Charles P. Colvin, of Saginaw, treasurer; Arthur B. Harford, of Detroit, secretary and general manager, and Malcolm McGregor, of Detroit. The company has been incorporated for the term of 20 years and stock is placed at $25 per share.

SILVER LAKE, N. H.—The Manchester Telephone Company, with a capital of $125,000, has been incorporated under the general laws.

Increase of Capital Stock.

CHESTER, PA.—The directors of the Media, Middletown, Aston & Chester Electric Company have voted to increase its capital stock from $30,000 to $150,000.

BOSTON, MASS.—The capital stock of the New London Street Railway Company will be increased October 15, by the issue at par of one new share for each 10 old shares to such stockholders of record October 1 as may subscribe therefor on or before October 15. The new stock will be entitled to future dividends.

YOUNGSTOWN, OHIO.—The Park & Falls Electric Railway Company will increase its capital stock from $50,000 to $200,000.

New Manufacturing Companies.

MILWAUKEE, WIS.—The Werner-Schenck company, to deal in supplies. The capital stock is $6,000. The incorporators are F. M. Werner, Arthur J. Schenck and F. P. Werner.

SACO, ME.—Louis McCarty Insulating Company has been incorporated with Thomas Allen, president; Louis McCarty, treasurer, Boston, Mass., to manufacture insulators for electrical purposes. Capital stock, $200,000.

CLEVELAND, OHIO.—The Globe Electric Company has been incorporated by J. L. Barron, T. W. Arwood, Jr., Donald McKenzie, L. W. Bradley, and C. E. Cotting. Capital stock, $25,000.

PHILADELPHIA, PA.—The Shuttleworth Electric Company has been incorporated with $100,000 capital.

Government Bids Wanted.

WASHINGTON, D. C.—The Treasury Department is inviting proposals until October 16 for all the labor and materials required to place complete in the United States Post Office Building at Lowell, Mass., a system of electric lighting. Additional particulars may be obtained from the Treasury Department, or by addressing Gardner W. Pearson, custodian of the building, Lowell, Mass.

Business Troubles.

SPOKANE, WASH.—The plant of the Pullman Electric Light and Power Company, including wires and poles, has been sold. It was bid in by the mortgagees and the entire plant will soon be removed.

SPECIAL TRAIN TO MONTREAL.

The special train to the Montreal Convention of the American Street Railway Association will leave the Grand Central Station, New York city,

MONDAY, OCTOBER 14, AT SIX P. M.

A reduced rate of a fare and one-third has been granted, making the cost for the round trip, $13.35.

Tickets, berths, etc., can be secured from M. C. Roach, general eastern passenger agent, 413 Broadway, N. Y.

As this train will pass through the interesting Adirondack scenery of the New York Central road, a day ride with a stop at Lake Saranac is contemplated for the return trip on Saturday, October 19.

All who intend to go on this train should at once write to Mr. Roach or to some member of the committee, which is composed of Col. John N. Partridge, of Brooklyn; Mr. James H. McGraw, Havemeyer Building, New York, and Mr. Chas. W. Price, 13 Park Row, N. Y.

INDUCTION COILS.

MAGNET SPOOLS.

For Arc Lamps, Telephones, Telegraph Apparatus, Electric Bells, Annunciators and Electric Motors.

C. F. SPLITDORF, Manufacturer, 17-27 Vandewater St., N. Y.

FINE WIRE WINDING OF EVERY DESCRIPTION.

ARC LAMP PATENT FOR SALE.

The United States patent on an arc lamp for both alternating and direct currents is offered for sale. A liberal commission will be paid to any one effecting the sale. A model lamp may be seen by appointment. Address, with references, "ARC LAMP," care of ELECTRICAL REVIEW, 13 Park Row, New York.

MESCO DRY BATTERY.

A standard battery for all open circuit or intermittent work. Highly recommended for Telephone Transmitters.

OVER 230,000 SOLD DURING THE PAST YEAR.

For sale by nearly all the Electrical Supply Houses in the United States.

GIVE IT A SEVERE TEST. Unreliable Dry Batteries are not sold much cheaper than the MESCO.

64 PAGE PAMPHLET FREE. Catalogue, 208 pages, 10 cts.

MANHATTAN ELECTRICAL SUPPLY CO.,

32 Cortlandt Street, New York.

Telephone Induction Coils.

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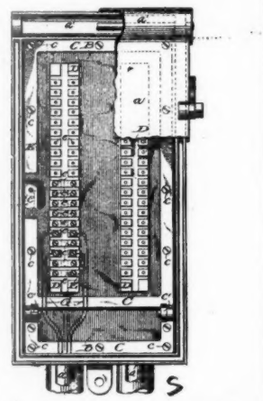
ELECTRICAL PATENTS

ISSUED OCTOBER 1, 1895.

546,996 Armature for electric motors and dynamo electric machines; H. Chitty, London, Eng.

547,031 Contact for electrically propelled vehicles; E. B. Reichel, Charlottenburg, Germany. — A horizontal arm extending transversely to the trolley conductor and adapted to make rubbing contact therewith, a bar or strip of anti-friction metal mounted upon the face of said arm.

547,034 Electric vibrator mechanism. 547,035 Electrical indicating mechanism; F. J. Russell, New York, N. Y.—A device for indicating whether an arc light is still burning or out.

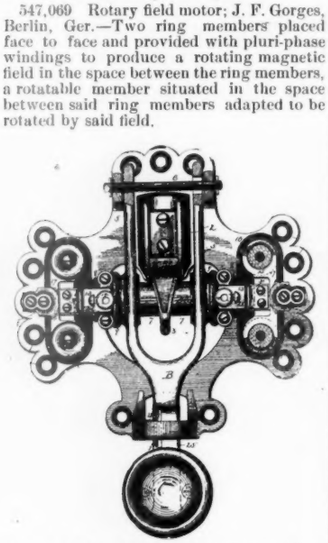


No. 547,078.—ELECTRICAL JUNCTION BOX.

547,043 Rectifier for electrical currents; W. J. Still, Toronto, Canada.

547,068 Electric motor truck; W. G. Gaither, Chicago, Ill.—Composed of side bars having projections forming seats, cross bars arranged thereon, a plate arranged to slide upon said projections, a spring interposed between said plate and cross bars and a bolt to retain said plate in place.

547,069 Rotary field motor; J. F. Gorges, Berlin, Ger.—Two ring members placed face to face and provided with pluri-phase windings to produce a rotating magnetic field in the space between the ring members, a rotatable member situated in the space between said ring members adapted to be rotated by said field.



No. 547,106.—HANGER BOARD FOR ARC LAMPS.

547,072 Electric device for controlling actions of musical instruments; F. W. Hedgeland, Chicago, Ill. — A perforated strip and a circuit closer having pins and a cross bar having an insulating strip.

547,077 Electric railway repair wagon; A. Iske, Lancaster, Pa.

547,078 Electrical junction box; W. S. Johnson, Milwaukee, Wis. — A suitable casing, an elastic insulating partition impervious to moisture and adapted to divide said casing into two compartments.

547,106 Hanger board for electric arc lamps; T. E. Adams, Cleveland, Ohio.—A base plate and a lever pivotally connected thereto, transverse insulating sleeves mounted in said lever, a conducting bar passing through said insulating sleeves and contact springs secured to the base plate and adapted to engage the ends of said bar.

547,120 Insulating compound; S. Heimann, New York, N. Y.—Pulverized asbestos, pulverized glass, rubber, rosin oil, mirbane oil, castor oil and dissolved celluloid.

547,127 Electric arc lamp; J. W. Olan, New York, N. Y.—A lamp provided with liquid electrodes and an exhausted inclosure therefor.

547,149 Electric switch; N. Marshall, Boston, Mass.

547,215 Portable electric drill; J. W. Jaimison, Vallejo, Cal.

547,230 Automatic electric switch; G. W. Russell, Denver, Colo.

547,240 Electrical safety apparatus for railways; L. W. Briggs, Chicago, Ill.—A spring adapted to unscrew a valve from its seat, said valve controlling the supply of steam to the piston cylinder of an engine, and an electro-magnet adapted to release a detent holding said spring in place and a trolley connected with the magnet and adapted to contact with a circuit wire adjacent to the locomotive track.

547,249 Incandescent lamp; H. Green, Hartford, Conn.

547,265 Telephone; H. T. Johnson, Elizabeth, N. J.—A call bell and a telephone in normally closed parallel circuits, a magneto in a branch of the bell circuit, and a switch for breaking the telephone circuit and at the same time closing circuit through the bell and the magneto.

547,283 Trolley and trolley pole; W. L. Pepper, Philadelphia, Pa.—Comprises telescoping sections, rods pivoted to the sections, pivoted levers pivoted to the said rods, and means for tilting the said levers to cause the upper sections to be extended.

547,302 Electric motor for street cars; W. Stine, Omaha, Neb.

547,304 Conduit supply system for electric railways; G. Tolmie, Carbon, Wyo.—Two metallic projections supported normally out of contact, a collapsible moisture-proof casing therefor, a weighted pivoted lever having a movable projection at one end, provided with a conductive facing, which said end is attached to the casing, electrical connections between the said facing and one of the points within the casing; electrical connections between the opposing point within the casing and a feed conductor; and a collector adapted to engage the projection on the lever and depress it to establish contact between the points within the casing.

547,323 Electric motor; A. E. Boggs, Allegheny, Pa.

547,358 Electric synchronizer for clocks; H. S. Prentiss, Elizabeth, N. J.—A circuit closer consisting of two levers, a cam on one arbor constructed to permit one of said levers to drop, a cam on a second arbor arranged to permit the second lever to drop, means for raising the levers, a metallic connection between the two levers and contacts.

547,369 Device for controlling speed of electric cars; J. Brady, Brooklyn, N. Y.

547,383 Reciprocating electric engine; F. B. Rae, Detroit, Mich. — An electro-magnet having coils contained in different windings in the conductors forming the circuit of a multiphase generator whereby a progressive field of force is produced in said magnet, a plunger for such magnet and a reversing switch.

547,388 Telephone exchange system; E. E. Yaxley, Chicago, Ill.

547,405 Telephone apparatus; G. J. Thompson, Malden, Mass.

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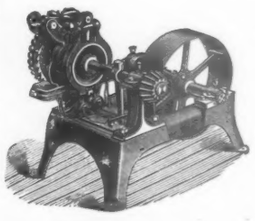

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